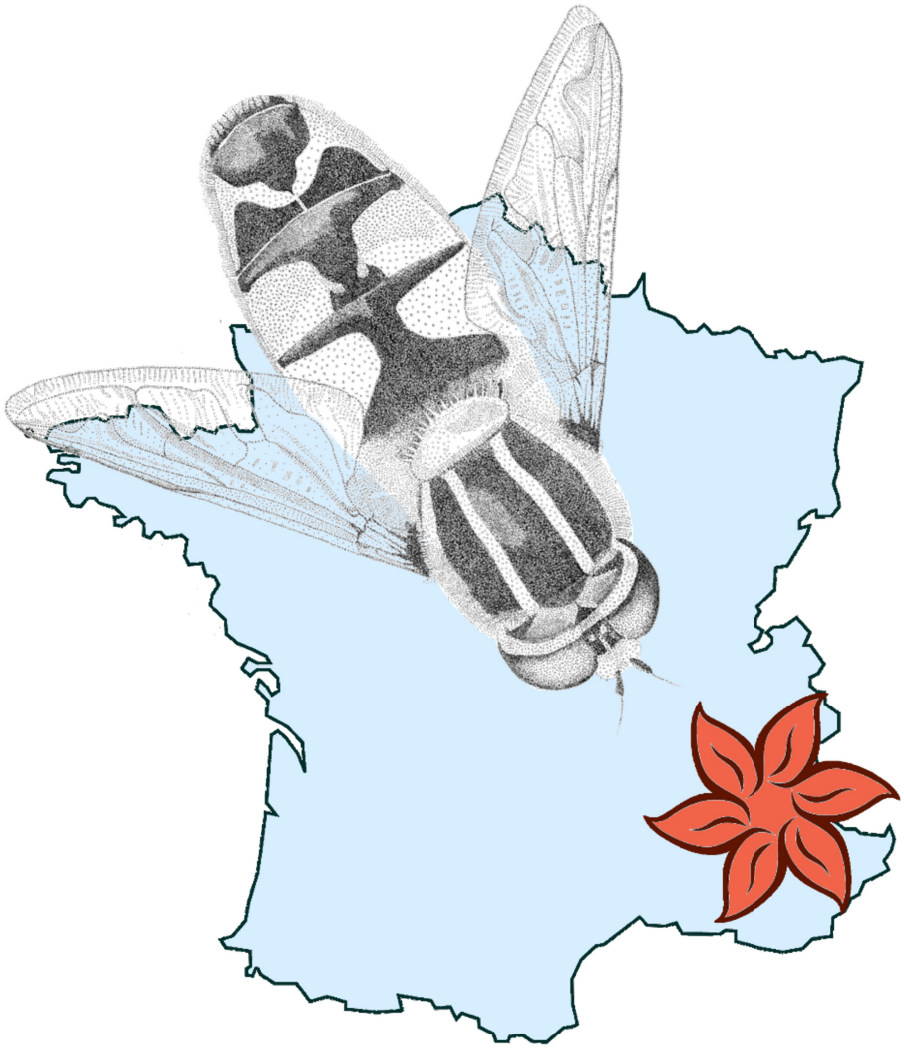
Institut méditerranéen de biodiversité
et d'écologie - marine et continentale -

11th International Symposium on Syrphidae

5th – 10th September 2022

Barcelonnette, France



Programme and Abstracts

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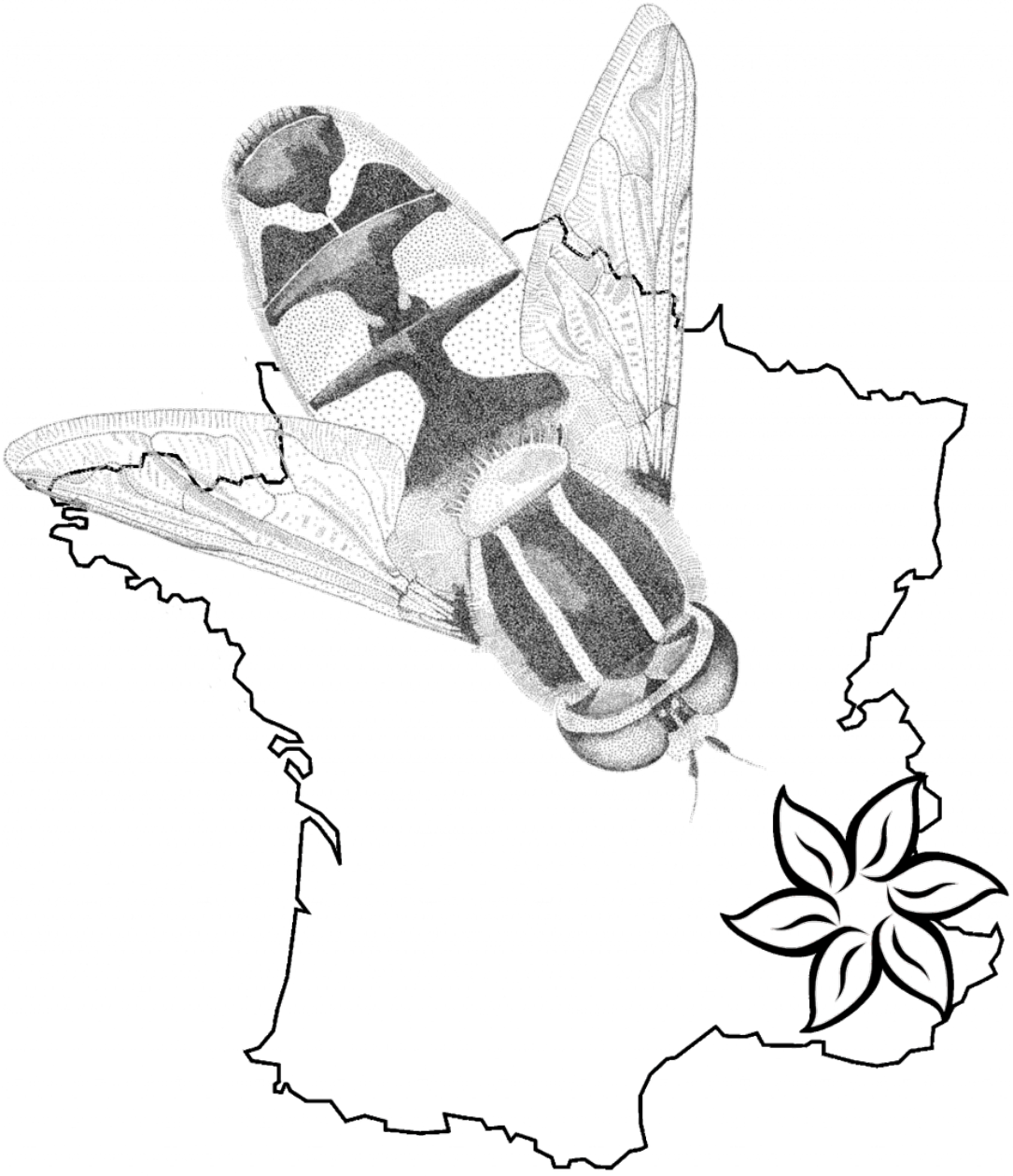

11th International Symposium on Syrphidae

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Programme and Abstracts

Edited by Gabriel Nève

International Scientific Committee
Francis Gilbert, University of Nottingham, Nottingham, United Kingdom
Kurt Jordaens, Royal Museum for Central Africa, Tervuren, Belgium
Hervé Jourdan, Institut de Recherche pour le Développement and IMBE, Nouméa, Nouvelle Calédonie
Ximo Mengual, Zoologisches Forschungsmuseum Alexander Koenig, Bonn, Germany
Gabriel Nève, IMBE and Université d'Aix-Marseille, France
Véronique Sarthou, SYRPHYS Agro-Environnement, Toulouse, France
Gunilla Ståhls, Finnish Museum of Natural History, Helsinki, Finland
Ante Vujić, University of Novi Sad, Novi Sad, Serbia

Local Organizing Committee
Alrick Dias, computer specialist, IMBE
Benoît Geslin, lecturer , IMBE
Thomas Lebard, independant entomologist
Jean-Yves Meunier, entomologist, IMBE
Gabriel Nève, lecturer, IMBE
Lise Ropars, lecturer, Muséum National d'Histoire Naturelle, Paris
Camille Ruel, in charge of scientific projects, IMBE
Lucie Schurr, temporary lecturer, IMBE

Hosting Institution
Institut Méditerranéen de Biodiversité et d'Écologie marine et continentale (IMBE)
Case 421, Aix-Marseille Université
Avenue Escadrille Normandie-Niemen
13397 Marseille cedex 20
France
`http://www.imbe.fr/`

Congress Venue
Pôle d'accueil universitaire Séolane
Quartier du 11ème BCA
04400 Barcelonnette
France
`https://seolane.org/`

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Symposium logo
Logo by Lise Ropars, with a drawing by Jean-Yves Meunier based on his photograph of *Helophilus trivittatus*, taken at Fos-sur-Mer, Bouches-du-Rhône, on 24 May 2018.

Contents

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Introduction

This symposium is the eleventh in the series started by a workshop organised in Stuttgart in July 2001. Since the 2003 meeting, when it took the name "symposium", entomologists working on Syrphidae meet every two years. This 11th Symposium was due to take place in 2021, but had to be postponed due to the COVID19 pandemic.

This is the first time that the **International Symposium on Syrphidae** is taking place in France. French syrphidology has a long history, starting with the works of Johann Wilhelm Meigen (1764-1845), who started publishing in French and whose collection is now hosted in the Paris Muséum, Pierre Macquart (1776-1855) and Edouard Perris (1808-1878) in the nineteenth century, to the important syntheses of Eugène Séguy (1889-1985).

At the beginning of the years 2000, several dedicated entomologists gathered on an online group linked with Cyrille Dussaix's famous Syrphidae Europense web site. The present online group, direct descent from Dussaix's has about 50 subscribers. Around the year 2010 a group of entomologists working for the Réserves Naturelles de France started using the Syrph-the-Net method, thanks to inputs by Martin Speight, Emmanuel Castella and Jean-Pierre and Véronique Sarthou. As a result, the French hoverfly fauna is now reasonably well known, but the known distribution maps of many species are very sparse. The French hoverfly enthusiasts community is now flourishing, and we hope this Symposium will boost its activities. It was thus high time that Syrphidologists meet in France.

Entomologists starting working on syrphidae often do so because they are attractive. Thanks to widely available keys, most species are readily identifiable, at least in the middle and the north of Europe. The diversity of hoverfly life histories has made this group recognised as a good indicator group for environmental assessment. However, new species are still being discovered in Europe, and the basic work of identification remains sometimes difficult. Molecular approaches combined with ecological data and morphological descriptions are necessary, and these often result in team work where academics and dedicated amateurs from several countries work together. These collaborations are often the result of meetings such as this one.

It is thus a great pleasure to welcome about eighty syrphidologists from South Africa, Iran, Colombia, Brazil, Canada, Australia and fourteen European countries.

I wish you all a successful meeting.

Gabriel Nève

General Remarks

Programme online
The full programme, including abstracts and graphical abstracts, is also available online to all registered Symposium participants on `https://syrphidae11.sciencesconf.org/program`.

To the speakers
You should upload your presentation on the Symposium computer either the day before if you speak in the morning or in the morning if your presentation is scheduled for the afternoon. Please, be present in the conference room 15 min before the beginning of your session in order to introduce yourself to the session chair.

Meals
Dietary requests made on the registration form have been forwarded to the kitchen staff. Please identify yourself to get the requested meal.

Collecting
As no hoverfly is legally protected in France, participants are free to collect hoverflies on public grounds, and on private grounds providing they have the authorization of the land owner. No collection of any kind is allowed in Nature Reserves or in the core zone of National Parks. The Lac du Lauzanier, which some of us will visit on Friday, lies within the core zone of the Mercantour National Park. Only the Symposium members who are listed in the permit issued by the Park on 26 July 2022 are allowed to collect in the Park, and this only between the 5th and the 10th of September, 2022. Thanks to all delegates to follow the Park rules !

Disclaimer
This work is not issued for the purpose of public and permanent scientific record, or for purposes of taxonomic nomenclature, and as such is not published within the meaning of the various codes. Thus, any nomenclatural act contained herein (e.g. new combinations, new names) does not enter biological nomenclature or pre-empt publication in another work.

Programme

Monday 5th September 2022

16:00 - 19:00 Registration

19:30 - 21:00 Welcome Dinner

Tuesday 6th September 2022

08:00 - 09:00 Registration

09:00 - 09:15 **Gabriel Nève**
Welcoming speech

Session 1. Phylogeny, systematics and taxonomy
Chair: **Ximo Mengual**

09:15 - 09:45 Plenary talk [**cancelled**]
Babak Gharali
Interactive keys, a useful approach to applied aspects of taxonomy

09:45 - 10:00 **Iván Ballester-Torres, Antonio Ricarte, Zorica Nedeljković, Mª Ángeles Marcos-García**
Diversity of the Iberian *Cheilosia* Meigen (Diptera: Syrphidae), including new taxonomic findings for the genus

10:00 - 10:15 **Pablo Aguado-Aranda, Antonio Ricarte, Zorica Nedeljković, Mª Ángeles Marcos-García**
The species group of *Eumerus tricolor* (Fabricius, 1798) in the Iberian Peninsula: taxonomy and systematics

10:15 - 10:30 **Sander Bot, Ximo Mengual, Frank Van de Meutter, Jeffrey Skevington**
The genus *Cheilosia* Meigen (Diptera: Syrphidae) in the Caucasus with the description of eleven new species

10:30 - 11:00 Coffee break

Chair: **Gunilla Ståhls**

11:00 - 11:15 **Ximo Mengual, Christoph Mayer, Trevor O. Burt, Kevin M. Moran, Lars Dietz, Gaby Nottebrock, Thomas Pauli, Andrew D. Young, Marie V. Brasseur, Sandra Kukowka, Scott Kelso, Claudia Etzbauer, Sander Bot, Martin Hauser, Kurt Jordaens, Gil F. G. Miranda, Gunilla Ståhls, Wouter van Steenis, Ralph. S. Peters, Jeffrey H. Skevington**
Systematics and evolution of Syrphinae based on exon-capture sequencing

11:15 - 11:30 **Kevin Moran, Jeffrey H. Skevington, Scott Kelso, Ximo Mengual, Andrew Young**
Cutting the knot: Untangling a paraphyletic Eristalinae (Diptera: Syrphidae) using phylogenomics

11:30 - 11:45	**Menno Reemer, Kevin M. Moran, Jeffrey H. Skevington, Scott Kelso, Ximo Mengual** Next generation sequencing reveals a new hypothesis of Microdontinae relationships
11:45 - 12:00	**Kurt Jordaens, Georg Goergen, John Midgley, Terence Bellingan, Bonolo Mosime, Marc De Meyer, Jeroen van Steenis** Syritta diversity in the Afrotropical Region
12:00 - 12:15	**Terence Bellingan, John Midgley, Kurt Jordaens, Georg Goergen** A revision of the hoverfly genera *Chrysogaster* and *Orthonevra* (Diptera: Syrphidae: Eristalinae) from the Afrotropical Region
12:30 - 14:30	Lunch and Poster Session

Chair: **Ante Vujić**

14:30 - 14:45	**Gunilla Ståhls, Ante Vujić, Snežana Radenković, Axel Ssymank, Libor Mazánek, Ximo Mengual, Jeroen van Steenis, Marija Miličić, Tamara Tot, Ana Grković, Laura Likov, Marina Janković, Martin Speight, Aino Juslén** Taxo-Fly project - a EU funded Service Contract to generate Taxonomic Resources for European hoverflies
14:45 - 15:00	**Sander Bot, Ana Grković, Laura Likov, Tamara Tot, Ante Vujić, Gunilla Ståhls** Photographing European hoverflies (Diptera, Syrphidae) as part of the Taxo-Fly project
15:00 - 15:15	**Jeffrey Skevington** Revision of Australian Syrphidae [**cancelled**]
15:15 - 15:30	**Andrea Aracil, Ana Grković, Celeste Pérez-Bañón, Ana Juan, Snežana Radenković, Ante Vujić, Santos Rojo** A remarkable new species of the genus *Eumerus* (Diptera: Syrphidae) from southeastern Spain, including a deep description of preimaginal morphology and notes about their trophic habits

Session 4: Functional and applied ecology

15:30 - 15:45	**Arlette Fauteux, António Soares, Eric Lucas** Larval development and voracity of *Eupeodes americanus* (Diptera: Syrphidae): comparison of the focal prey, *Aphis gossypii* (Hemiptera: Aphididae) and the banker prey, *Rhopalosiphum padi* (Hemiptera: Aphididae)
15:45- 16:00	**Noémie Gonzalez, Arlette Fauteux, Jean-Christophe Louis, Rose Buitenhuis, Eric Lucas** Impact of different banker plant systems on the oviposition preferences of the American hoverfly, *Eupeodes americanus*
16:00 - 16:30	Coffee Break
16:30 - 19:00	Poster session or Practicals on systematics and identification (Lab Room)
19:30 - 21:00	Dinner

Wednesday 7th September 2022

09:00 - 09:15 **Thomas Lebard & Lise Ropars**
Information on the excursions

Session 2. Monitoring and Conservation
Chair: **Kurt Jordaens**

09:15 - 09:45 Plenary talk
Stuart Ball & Roger Morris
The GB Hoverfly Recording Scheme in a time of change

09:45 - 10:00 **Aat Barendregt, Theo Zeegers, Wouter van Steenis, Eelke Jongejans**
Syrphidae-decline evaluated after 43 years monitoring in a Dutch forest

10:00 - 10:15 **Roger Morris & Stuart Ball**
Hoverflies and climate change - making sense of trends

10:15 - 10:30 **Jocelyn Claude, Romain Decoin, Bruno Tissot, Martin C.D. Speight, Emmanuel Castella, Suzanne Forêt**
Vulnerability of subalpine habitats to climate change: the case of Diptera Syrphidae in the Hauts de Chartreuses National Nature Reserve (Isère, 38) between 2008 and 2020

10:30 - 11:00 Coffee break

Chair: **Menno Reemer**

11:00 - 11:15 **Stuart Ball & Roger Morris**
A range shift in *Leucozona glaucia* in Great Britain

11:15 - 11:30 **Axel Ssymank**
Overview of knowledge of hoverfly decline (Diptera: Syrphidae) in Germany

11:30 - 11:45 **Ante Vujić**
The European Red List of Hoverflies - challenges and opportunities

11:45 - 12:00 **Dominique Langlois**
Dynamics around syrphids in the French Natural Reserves

12:00 - 12:15 **Marina Janković Milosavljević, Marija Miličić, Snežana Popov, Ante Vujić**
Newly designated hoverfly (Diptera: Syrphidae) species of conservation concern and Prime Hoverfly Areas in Serbia

12:15 : 12:30 **David Bennett**
No significant effect of semi-natural habitats coverage or connectivity on Syrphid abundance and diversity in wildflower compensation areas

12:30 - 14:30 Lunch and Poster Session

Session 4. Functional and applied ecology
Chair: **Laura Likov**

14:30 - 15:00	Plenary talk **Myles Menz** A global perspective of hoverfly migration
15:00 - 15:15	**Will Hawkes, Toby Doyle, Scarlett Weston, Kelsey Davies, Richard Massy, Karl Wotton** The most remarkable of migrants - four years of insect migration monitoring at a Pyrenean Mountain pass
15:15 - 15:30	**Antonín Hlaváček, Radek Lučan, Jiří Hadrava** The autumnal migration of hoverflies with special focus on sex ratio and timing of migration
15:30 - 15:45	**Stuart Ball** Maps for "Hoverflies of NW Europe"
15:45- 16:00	**Roger Morris & Stuart Ball** Phenological change in Britain's hoverflies
16:00 - 16:30	Coffee Break

Round table : Pollination monitoring
Chair: **Francis Gilbert**

16:30 - 16:42	**Santos Rojo, Celeste Pérez-Bañón, Andrea Aracil, Guillermo Bañares-de-Dios, Elena Bermejo, Estrella Yanguas-Fernández, Pablo Núñez, Guillermo Cabezas, Paula Romero, Noelia Vallejo** European Project SPRING: "Strengthening Pollinator Recovery through INdicators and monitorinG": challenges and opportunities for hoverflies in the Spanish EUPoMS (Diptera: Syrphidae)
16:42 - 16:54	**Wouter van Steenis** A European Monitoring Scheme for Syrphidae and other pollinators
16:54 - 17:06	**Snežana Radenković** EU Pollinator Monitoring Scheme (EUPoMS): what would be the most appropriate way to monitor Syrphidae at the European level
17:06 - 18:00	Discussion
19:30 - 21:00	Gala Dinner

Thursday 8th September 2022

Session 3: Faunistics and biogeography
Chair: **Francis Gilbert**

09:00 - 09:30	Plenary talk **Augusto Leon Montoya Giraldo** Diversity of Syrphidae in the Tropical Andes
09:30 - 09:45	**Daniele Sommaggio** Hoverflies (Diptera: Syrphidae) in the Alpine National Parks of Italy [**cancelled**]
09:45 - 10:00	**Lisa Fisler** Syrphin' Switzerland: aims and achievements of a recent Syrphidae project in the country
10:00 - 10:15	**John Midgley, Terence Bellingan, Kurt Jordaens** A preliminary checklist of Syrphidae from South Africa
10:15 - 10:30	**André Fontinelle Magalhães, Márcia Couri, Mírian Morales** Predatory Syrphinae of phytophagous insects in Brazil: taxonomy, interaction network and agricultural host plants
10:30 - 11:00	Coffee break

Chair: **Santos Rojo**

11:00 - 11:15	**Grigory Popov, Viktor Shparyk, Alex Prokhorov, Iryna Lezhenina, Ruslan Mishustin, Anastasia Lishchuk** Catalogue of the Syrphidae of Ukraine: an annotated checklist, with distributions and bibliography
11:15 - 11:30	**Leendert-Jan van der Ent** Working towards a checklist of Bulgarian hoverflies
11:30 - 11:45	**Klára Daňková, Antonín Hlaváček, Daniel Benda, Petr Bogusch, Jiří Hadrava** Hoverflies as mimics of the Oriental hornet (*Vespa orientalis*)
11:45 - 12:00	**Andrea Aracil, Adrián Bosquet, Celeste Perez, Santos Rojo** First data about demography and population parameters under captive rearing conditions of *Eumerus* Meigen, 1822 genus (Diptera: Syrphidae)
12:00 - 12:15	**Augusto Montoya Giraldo, Juan Parra, Marta Wolff** Structure and diversity of flower flies (Diptera: Syrphidae) in northwestern Colombian Paramos: towards the identification of bioindicator species in the Tropical Andes
12:15 : 12:30	**Dominique Langlois** *Leucorum vernum*, an alternative larval host plant for *Merodon analis* in East part of France
12:30 - 14:30	Lunch and Poster Session

Session 4. Functional and applied ecology
Chair: **Véronique Sarthou**

14:30 - 14:45	**Adrian Jaich, Melanie Wohlrab, Annette Herz** The attractiveness of alternative crops in agricultural landscapes on local hoverfly populations
14:45 - 15:00	**Lucie Schurr, Gabriel Nève, Véronique Masotti, Laurence Affre, Sophie Gachet, Benoît Geslin** Landscape and local drivers influence on syrphids of fennel crops in Provence and implications for its yield
15:00 - 15:15	**Mario App, Jan Thiele, Boris Schröder** SyrFitSources: Investigating the effects of landscape composition and configuration on population dynamics of aphidophagous hoverflies with an agent-based model
15:15 - 15:30	**Jiří Hadrava, Zdeněk Janovský, Jakub Štenc, Jan Klečka** On generalist pollinators and the role of hoverflies in communities of pollinators
15:30 - 15:45	**Paula Montoya-Pfeiffer, Carlos Sarmiento Monroy, Augusto Montoya Giraldo, Eliana Buenaventura, Jenny Rodríguez-Rodríguez** Functional diversity of neotropical mangrove pollinators and their responses to land use change
15:45- 16:00	**Jonathan Heal** Behavioural strategies of two *Eristalis* species - observations in the pandemic year
16:00 - 16:30	Coffee Break

Session 5: Open topics on Syrphidae
Chair: **John Midgley**

16:30 - 16:45	**Marija Miličić, Marina Janković, Snežana Popov, Andrijana Andrić, Jelena Ačanski, Ante Vujić** Hoverfly (Diptera: Syrphidae) research in the past 25 years - a bibliometric analysis
16:45 - 17:00	**Jeroen van Steenis, Leendert-Jan van der Ent, Francis Gilbert, Roger Morris, Gerard Pennards, Tsung-Hsueh Wu, Axel Ssymank** Introducing *Journaal van Syrphidae*
17:00 - 17:15	**Bastiaan Wakkie** The Current status of the new `syrphidae.com` website
17:15 - 18:00	Discussion
19:30 - 21:00	Dinner

Posters

1 **Willian Almeida**
Interaction between hoverflies (Diptera: Syrphidae) and inflorescences of *Spondias tuberosa* Arruda (Anacardiaceae) in Ituiutaba, Minas Gerais, Brazil [cancelled]

2 **Andrea Aracil, Andrijana Andric, Celeste Pérez-Bañón, Snežana Radenković, Ante Vujić, Santos Rojo**
Preimaginal morphology of the European endemic species *Merodon triangulum* Vujić, Radenković & Hurkmans, 2020 of the *Merodon constans* group (Diptera: Syrphidae)

3 **Jelena Ačanski, Ante Vujić, Tamara Tot, Marija Miličić, Snežana Radenković**
The importance of R4+5 vein shape in cryptic species delimitation - a case study of the *Merodon aureus* species complex (Diptera: Syrphidae)

4 **Xavier Brits, Hannelie Human, John Midgley, Christopher Weldon**
Hoverfly (Diptera: Syrphidae) abundance in sunflower fields in the Lehau region of Limpopo province, South Africa

5 **Mihajla Djan, Nataša Kočiš Tubić, Tamara Tot, Ljiljana Šašić Zorić, Iva Gorše, Ante Vujić, Snežana Radenković**
Database of DNA barcodes of hoverflies in Serbia– essential tool for environmental DNA survey

6 **Isabella Forini-Giacalone, Lucia Pollini Paltrinieri, Bärbel Koch**
Hoverflies (Diptera: Syrphidae) of the Bolle di Magadino - Biodiversity and habitat assessment using the Syrph the Net method

7 **Iva Gorše, Ljiljana Šašić Zorić, Marija Miličić, Mihajla Djan, Gunilla Ståhls, Ante Vujić**
Spatial patterns of COI haplotype diversity in response to environmental factors – case study on *Merodon aerarius* (Diptera: Syrphidae)

8 **Ana Grković, Jelena Ačanski, Tamara Tot, Ante Vujić, Snežana Radenković**
Species relationships in the genus *Eumerus* (Diptera: Syrphidae) based on morphological evidence

9 **Kurt Jordaens, Terence Bellingan, John Midgley, Marc De Meyer**
The Diversity of Pollinating Diptera in South African biodiversity hotspots (DIPoDIP) project

10 **Bärbel Koch, Lucia Pollini Paltrinieri, Isabella Forini-Giacalone**
Hoverflies (Diptera: Syrphidae) of the Parco delle Gole della Breggia - Biodiversity and habitat assessment using the Syrph the Net method

11 **Nataša Kočiš Tubić, Mihajla Djan, Ante Vujić, Snežana Radenković**
New additions to species genetic characterization of *Merodon clavipes* and *Merodon pruni* (Diptera: Syrphidae) species groups

12 **Laura Likov, Snežana Radenković, Ante Vujić**
New records on the distribution and diversity of *Merodon* Meigen, 1803 (Diptera: Syrphidae) in Middle East and Central Asia

13 **Suzana Malidžan, Milica Ranković, Snežana Radenković, Ante Vujić**
Fauna of hoverflies (Diptera: Syrphidae) of less explored Mediterranean mountains in Montenegro

14 **Umberto Maritano**
Proposal of a new monitoring method for *Mallota fuciformis* (Diptera: Syrphidae), a saproxylic pollinator

15 **John Midgley, Kurt Jordaens, Bonolo Mosime**
Potential Effect of Climate Change on the Distribution of Afrotropical *Syritta* species (Diptera: Syrphidae)

16 **John Midgley, Terence Bellingan, Kurt Jordaens, Georg Goergen**
Biological observations of *Meromacroides meromacriformis* (Bezzi, 1915) (Diptera: Syrphidae) in South Africa

17 **John Midgley, Terence Bellingan, Kurt Jordaens**
Taxonomic notes on *Spheginobaccha pamela* Thompson & Hauser, 2015

18 **John Midgley, Terence Bellingan, Kurt Jordaens**
Taxonomic notes on the genus *Amphoterus* Bezzi, 1915

19 **Augusto Leon Montoya Giraldo, Gil Miranda**
Origin, diversity and endemism of the Neotropical Syrphidae: implication for conservation of rare and threatened genera

20 **Augusto Leon Montoya Giraldo, F. Christian Thompson**
The flower flies of subgenus *Platycheirus* (*Tuberculanostoma*) Fluke as flagship entities for the conservation of Páramo ecosystems in Tropical Andes

21 **Luhlumelo Mva, Timo van der Niet, Kurt Jordaens, John Midgley**
Diversity of hoverflies (Diptera: Syrphidae) in three habitat types in the Karkloof, KwaZulu-Natal, South Africa

22 **Zorica Nedeljković, Antonio Ricarte, Ximo Mengual**
The North African hoverflies of the genus *Xanthogramma* Schiner, 1861 (Diptera: Syrphidae): a new species uncovered

23 **Tapani Neuvonen, Jere Kahanpää, Gunilla Ståhls**
Hoverflies (Diptera: Syrphidae) in the Diptera Eastern Fennica collections of the Finnish Museum of Natural History Luomus

24 **Gabriel Nève, Samuel Hilaire, Arnaud Klein, Xavier Lair, Christophe Lauriaut, Thomas Lebard, Jean-Yves-Meunier, Lise Ropars**
List of the hoverflies (Diptera: Syrphidae) of Bouches-du-Rhône (France)

25 **José Orengo-Green, Antonio Ricarte, Javier Quinto, Mª Ángeles Marcos-García**
Morphology of the first early stages of *Milesia* ever found in Europe.

26 **Lucia Pollini Paltrinieri, Isabella Forini-Giacalone, Bärbel Koch**
The hoverflies (Diptera: Syrphidae) of the Querco-Castagnetum forests in the area of the candidate Locarnese National Park

27 **Snežana Radenković, Mihajla Djan, Marija Miličić, Snežana Popov, Ante Vujić**
Monitoring of insect pollinators in Serbia – pilot project

28 **Milica Ranković, Dubravka Milić, Snežana Radenković, Tijana Nikolić, Suzana Malidžan, Ante Vujić**
Predicted impact of climate change on the distribution of some phytophagous hoverfly species (Diptera: Syrphidae: Merodontini) in Montenegro - from past to future

29 **Tamara Tot, Jelena Ačanski, Snežana Radenković, Zorica Nedeljković, Ana Grković, Ante Vujić**
Characterization of cryptic diversity within *Paragus bicolor* complex (Diptera: Syrphidae, Syrphinae, Paragini)

30 **Jeroen van Steenis, Tamara Tot, Ximo Mengual, Sander Bot, Gil Miranda, Jeffrey Skevington**
Hoverfly (Diptera: Syrphidae) adult terminology: an update and extension

31 **Ljiljana Šašić Zorić, Sanja Veselić, Milomir Stefanović, Gunilla Ståhls, Mihajla Djan, Ante Vujić**
16S rRNA gene sequence based *Wolbachia* screening in *Merodon* hoverflies

List of participants

AGUADO ARANDA, Pablo	University of Alicante, Spain aguado.aranda@gmail.com
ALMEIDA, Willian Fernandes	Universidade Federal de Uberlândia, Brazil willian.almeida@ufu.br
APP, Mario	Thünen Institute of Biodiversity, Germany mario.app@thuenen.de
ARACIL, Andrea	University of Alicante, Spain and.aracilgisbert@gmail.com
BALL, Stuart	Hoverfly Recording Scheme, United Kingdom stuart.ball54@gmail.com
BALLESTER TORRES, Iván	University of Alicante, Spain ivanballester96@gmail.com
BARENDREGT, Aat	Utrecht University, The Netherlands [Deceased on 4 Sept. 2022]
BELLINGAN, Terence	Albany Museum, South Africa ta.bellingan@gmail.com
BENNETT, David	Christian Albrecht's Universitat, Germany dbennett@ecology.uni-kiel.de
BOT, Sander	Independent entomologist, The Netherlands botsander@gmail.com
CLAUDE, Jocelyn	Independent entomologist, France jocelyn-claude@orange.fr
COMTE, Adeline	Entomo-logic, Neuves-Maisons, France adelinecomtefr@gmail.com
DAŇKOVÁ, Klara	Charles University, Czech Republic klara.dankova@atlas.cz
DJAN, Mihajla	University of Novi Sad, Serbia mihajla.djan@dbe.uns.ac.rs
DZIOCK, Frank	HTW Dresden, Germany Frank.dziock@htw-dresden.de
EBRAHIMI, Fereshteh	Qazvin Agricultural Education Center, Iran bgharaei@yahoo.com
FAUTEUX, Arlette	Université du Québec à Montréal, Canada fauteux.arlette@courrier.uqam.ca
FISLER, Lisa	Infofauna, Switzerland lisa.fisler@infofauna.ch
FORINI-GIACALONE, Isabella	Independent entomologist, Switzerland isa.forini@gmail.com
GESLIN, Benoît	IMBE, France benoit.geslin@imbe.fr
GHARALI, Babak	Research Center for Agriculture and Natural Resources, Iran bgharaei@mail.com
GILBERT, Francis	Nottingham University, United Kingdom francis.gilbert@nottingham.ac.uk
GILBERT, Hilary	United Kingdom hilarygilbert@hotmail.co.uk

GONZALEZ, Noémie	Université du Québec à Montréal, Canada gonzalez.noemie@courrier.uqam.ca
GORŠE, Iva	University of Novi Sad, Serbia ivagorse@gmail.com
GRKOVIĆ, Ana	University of Novi Sad, Serbia ana.grkovic@dbe.uns.ac.rs
HADRAVA, Jiří	Charles University, Czech Republic hadravajirka@seznam.cz
HADRAVOVÁ, Tereza	Charles Universiny, Czech Republic hadravovatereza@email.cz
HAWKES, Will	University of Exeter, United Kingdom willhawkesphotography@gmail.com
HEAL, Jonathan	Independent entomologist, United Kingdom jhalleynes@hotmail.com
HLAVÁČEK, Antonín	Charles University, Czech Republic antonin.hlavacek69@gmail.com
HODGKISS, Dylan	Olombria, United Kingdom dylan@flypollination.com
JAICH, Adrian	Julius Kühn-Institute for Biological Control, Germany Adrian.Jaich@julius-kuehn.de
JANKOVIĆ MILOSAVLJEVIĆ, Marina	University of Novi Sad, Serbia marinaj@dbe.uns.ac.rs
JORDAENS, Kurt	Royal Museum for Central Africa, Belgium kurt.jordaens@africamuseum.be
KOCH, Bärbel	Museo cantonale di storia naturale, Switzerland baerbel.koch@ti.ch
KOČIŠ TUBIĆ, Nataša	University of Novi Sad, Serbia natasa.kocis@dbe.uns.ac.rs
LAIR, Xavier	Independent entomologist, France x.lair@laposte.net
LANGLOIS, Dominique	Réserves naturelles de France, France dl.entomo@gmx.com
LEBARD, Thomas	Independent entomologist, France thomas_lebard@yahoo.fr
LIKOV, Laura	University of Novi Sad, Serbia laura.likov@dbe.uns.ac.rs
MAGALHÃES, André Fontinelle	Museu Nacional, Rio de Janeiro, Brazil fontinelleandre@gmail.com
MALIDŽAN, Suzana	Natural History Museum of Montenegro, Montenegro igormalidzan@gmail.com
MARITANO, Umberto	Independent entomologist, Italy umberto.maritano@gmail.com
MAZÁNEK, Libor	Regional public health authority in Olomouc, Czech Republic syrphidae@centrum.cz
MENGUAL, Ximo	Zoologisches Forschungsmuseum Alexander Koenig, Germany x.mengual@leibniz-lib.de
MENZ, Myles	James Cook University, Townsville, Australia mmenz@ab.mpg.de

MEUNIER, Jean-Yves	IMBE, France jean-yves.meunier@ird.fr
MIDGLEY, John	KwaZulu-Natal Museum, South Africa jmidgley@nmsa.org.za
MILIČIĆ, Marija	BioSense Institute, University of Novi Sad, Serbia marija.milicic@biosense.rs
MONTOYA, Augusto	Universidad de Antioquia, Colombia aleon.montoya@udea.edu.co
MORAN, Kevin	Carleton University, Canada syrphidae@kevinmoran.com
MORRIS, Roger	Hoverfly Recording Scheme, United Kingdom syrphid58@gmail.com
NEDELJKOVIĆ, Zorica	University of Alicante, Spain zoricaned14@gmail.com
NEUVONEN, Tapani	University of Helsinki, Finland tapani.neuvonen@helsinki.fi
NÈVE, Gabriel	IMBE, France gabriel.neve@imbe.fr
NIDERGAS, Valentin	MNHN, France valentin.nidergas@gmail.com
ORENGO GREEN, José Javier	Universidad de Alicante, Spain jj.orengo@ua.es
PARRET, Alexis	CPIE Touraine - Val de Loire, France alexisparret@hotmail.fr
PENNARDS, Gerard	Eurofins-Mitox, The Netherlands gerard_pennards@hotmail.com
PÉREZ-BAÑÓN, Celeste	University of Alicante, Spain celeste.perez@ua.es
PLUME, Laurent	Université de Corse, France plume_l@univ-corse.fr
POLLINI PALTRINIERI, Lucia	Museo cantonale di storia naturale, Switzerland lucia.pollini@ti.ch
POPOV, Grigory	I. I. Schmalhausen Institute of Zoology, Ukraine grigory.v.popov@gmail.com
RADENKOVIĆ, Snežana	University of Novi Sad, Serbia snezana.radenkovic@dbe.uns.ac.rs
RANKOVIĆ, Milica	University of Novi Sad, Serbia youthmc93@gmail.com
REEMER, Menno	Naturalis Biodiversity Center, The Netherlands menno.reemer@naturalis.nl
RICARTE, Antonio	University of Alicante, Spain ricarte24@gmail.com
ROJO, Santos	University of Alicante, Spain santos.rojo@ua.es
ROPARS, Lise	Muséum National d'Histoire Naturelle, France lise.ropars@univ-fcomte.fr
SARTHOU, Véronique	SYRPHYS Agro-Environnement, France contact@syrphys.com
SCHURR, Lucie	IMBE, France lucie.schurr@imbe.fr
SKEVINGTON, Angela	Canada angela_skevington@yahoo.ca

SKEVINGTON, Jeffrey	Agriculture and Agri-Food Canada, Canada jhskevington@gmail.com
SOMMAGGIO, Daniele	Bologna University, Italy daniele.sommaggio2@unibo.it
SPEIGHT, Martin	Trinity College, Ireland speightm@gmail.com
SSYMANK, Axel	Bundesamt für Naturschutz, Germany Ssymanka@t-online.de
STÅHLS, Gunilla	Finnish Museum of Natural History, Finland gunilla.stahls@helsinki.fi
TOT, Tamara	University of Novi Sad, Serbia tamarat@dbe.uns.ac.rs
VALLET, Anne	Entomo-logic, Neuves-Maisons, France avallet2@orange.fr
VAN DE MEUTTER, Frank	Instituut voor Natuur- en Bosonderzoek (INBO), Belgium frank.vandemeutter@inbo.be
VAN DER ENT, Leendert-Jan	Hoverfy Specialist Group of IUCN, The Netherlands ljvanderent@planet.nl
VAN NIEUWSTADT, Mark	Naturalis Biodiversity Center, Leiden, The Netherlands mark.vannieuwstadt@naturalis.nl
VAN STEENIS, Jeroen	Independent entomologist, The Netherlands jvansteenis@syrphidaeintrees.com
VAN STEENIS, Wouter	Independent entomologist, The Netherlands w.v.steenis@casema.nl
VESELIĆ, Sanja	Prirodno-matematički fakultet, Serbia sanja.veselic@dbe.uns.ac.rs
VUJIĆ, Ante	University of Novi Sad, Serbia ante.vujic@dbe.uns.ac.rs
WAKKIE, Bastiaan	syrphidae.com, Belgium bwakkie@syrphidae.com

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Eristalinus megacephalus, Fos-sur-Mer, Bouches-du-Rhône, France, 12 october 2018 ©G. Nève

List of abstracts in alphabetical order of first author

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The species group of *Eumerus tricolor* (Fabricius, 1798) in the Iberian Peninsula: taxonomy and systematics

Pablo Aguado-Aranda *† [1], Antonio Ricarte [1], Zorica Nedeljković [1], Mª. Ángeles Marcos-García [1]

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

The genus *Eumerus* Meigen, 1822 (Eristalinae: Merodontini) comprises 250+ described species worldwide. Within this genus, the *Eumerus tricolor* group is the largest of all those defined so far, and one of the groups with the highest level of morphological similarity. The *E. tricolor* group has 37 described species, of which nine are reported from the Iberian Peninsula. The aims of this work are (1) to update the taxonomic knowledge of the Iberian species of this group and (2) to confirm the validity of putative new species through morphological and molecular data (5' and 3' end regions of the Cytochrome *c* oxidase subunit I). The new species were found to be similar to *Eumerus sabulonum* (Fállen, 1847) and *Eumerus grandis* Meigen, 1822 and collected in southern Spain and Pyrenees, respectively. The systematic position of the new species in the framework of the *E. tricolor* group are assessed and discussed. Other novel taxonomic and faunistic data of species of the *E. tricolor* group from the Iberian Peninsula are provided.

This research belongs to the 'Fauna Ibérica' project (PGC2018-095851-A-C65) of the 'Ministerio de Ciencia, Innovación y Universidades', as well as to Pablo Aguado-Aranda's PhD (PRE2019-087508) and to the UATALENTO17-08 of the 'Vicerrectorado de Investigación y Transferencia del Conocimiento' of the University of Alicante.

*Speaker
†Corresponding author: aguado.aranda@gmail.com

Poster N° 1

Interaction between hoverflies (Diptera: Syrphidae) and inflorescences of *Spondias tuberosa* Arruda (Anacardiaceae) in Ituiutaba, Minas Gerais, Brazil.

Willian Almeida [1]

[1] Universidade Federal de Uberlândia (UFU) – Brazil

Hoverflies (Diptera: Syrphidae) provides important ecosystem services such as biological control and pollination. The flowers visited by hoverflies usually have light coloration, accessible nectar and pollen, gathered in inflorescences. The Anacardiaceae specie *Spondias tuberosa* Arruda, popularly called "umbu", is an endemic tree from Brazil, distributed along *Cerrado* and *Caatinga* biomes, their fruits are important source of alternative income to local population. The aim of this study was to collect and identify hoverflies visiting *S. tuberosa* and analyze the abundance and diversity of individuals throughout the year in Ituiutaba, Minas Gerais, Brazil. The individuals were collected with entomological net, for three hours in the morning from 7:00 am to 10:00 am, in urban areas (A1 and A4), conservation unit (A2) and rural area (A3), from June 2020 to October 2021. The faunal index was calculated through ANAFAU program. The flowering cycle of *S. tuberosa* was alternated between the four study areas, however, the floral interactions with the hoverflies were higher during the rainy season, this relationship was due to the higher production of "umbu" flowers in this period. A total of 345 specimens were captured, distributed in nine genera. Area A1 had the highest abundance of hoverflies with 216 insects (62.6%), followed by area A3 with 56 (16.2%), area A4 with 53 (15.4%) and area A2 with 20 (5.8%). *Allograpta* Osten Sacken, 1875, *Eristalinus* Rondani, 1845, *Ocyptamus* Macquart, 1834 and *Ornidia* Le Peletier & Serville, 1828 interacted with *S. tuberosa* flowers in all seasons. *Allograpta* was classified as superdominant, superabundant, superfrequent and constant in urban areas, while *Ocyptamus* indicated preference for rural areas (A3) and *Toxomerus* Macquart, 1855 preference for forest environment (A2). The flowers of *S. tuberosa* were very attractive to hoverflies, providing food resources, mainly to *Allograpta* in the urban environment.

Keywords: inventory, pollinator, Brazil southeast.

SyrFitSources: Investigating the effects of landscape composition and configuration on population dynamics of aphidophagous hoverflies with an agent-based model

Mario App * [1,2], Jan Thiele [1,2], Boris Schröder [3,4]

[1] Thünen Institute of Biodiversity – Germany
[2] Biodiversity of Agricultural Landscapes, Institute of Geoecology, Technische Universität Braunschweig – Germany
[3] Ecology and Environmental Systems Analysis, Institute of Geoecology, Technische Universität Braunschweig – Germany
[4] Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB) – Germany

The decline of insect biomass is an important aspect of biodiversity loss. To understand the drivers of this loss it is important to understand the factors affecting insect populations at multiple spatial and temporal scales. Spatially explicit models are a promising method to achieve this aim. Especially for hoverflies, a spatio-temporal life cycle model considering the different food resources for both imagines and larvae is missing.
In order to examine the effects of local habitat quality and landscape configuration on population dynamics, we developed an agent-based model (ABM) for the aphidophagous *Episyrphus balteatus*. To enable fast computation of syrphid behavior on a daily basis over many years in landscapes covering some square kilometers, we simplify the landscape to resource patches connected in a habitat network. To estimate the amount and phenology of floral resources per habitat, we used realistic lists of flowering plants for each habitat type based on the FloRes database. Further, the model simulates the development of aphid colonies dependent on air temperature, the feeding and progression of different stages of syrphid larvae, and the foraging behaviour and energy balance of imagines. The stage-specific larval mortality is calculated based on the number of aphids they feed daily and throughout the larval stage. For the imagines the mortality rate increases with the days the spend active and through the air temperature the active days were initiated.
Preliminary testing of the ABM shows that aphid availability is one of the most sensitive drivers of population development. However, sufficient floral resources matter for imagines, especially in spring. We are validating and fitting the models on a time series of *E. balteatus* abundance gathered with three Malaise traps set up in each of 13 landscapes located in rural sites of Lower Franconia and Lower Bavaria, Germany, in summer 2011.

Keywords: Insect decline, land use, *Episyrphus balteatus*, life cycle, larvae, imagines, aphids

*Speaker

A remarkable new species of the genus *Eumerus* (Diptera: Syrphidae) from southeastern Spain, including a deep description of preimaginal morphology and notes about their trophic habits.

Andrea Aracil * [1], Ana Grković [2], Celeste Pérez-Bañón [1], Ana Juan [1], Snežana Radenković [2], Ante Vujić [2], Santos Rojo [1]

[1] University of Alicante – Spain
[2] University of Novi Sad – Serbia

Eumerus Meigen 1822 (Diptera: Syrphidae) is one of the most speciose hoverflies genera, comprising around 280 different species worldwide. At least 170 species are known from Palearctic region, having its highest diversity in the Mediterranean Basin. Despite this high diversity, a lot of information is still unknown e.g. phylogeny relationships, the life cycle of most species and, in particular, knowledge on their larval morphology and other preimaginal stages. In fact, so far, only the preimaginal stages of 14 species are known, although a few more have been collected but remain undescribed. In the present communication, a new species of genus *Eumerus* belonging to *tricolor*-group is described and figured, also including description of preimaginal stages, life cycle, known distribution and host plant. Scanning Electron Microscopy were used for a deep study of the micromorphology of both, larva and pupa; in the same way, head skeleton was dissected from larvae, described and figured. A comparison of larval morphology with other species of the genus have been also done and discussed. The information obtained in this study provides valuable information on the speciation of this genus that will help to understand its adaptive radiation.

Keywords: *Eumerus*, Spain, new species, preimaginal morphology, life cycle

*Speaker

First data about demography and population parameters under captive rearing conditions of *Eumerus* Meigen 1822 genus (Diptera: Syrphidae)

Andrea Aracil * [1], Adrián Bosquet [1],
Celeste Pérez-Bañón * [1], Santos Rojo [1]

[1] University of Alicante – Spain

Eumerus Meigen 1822 (Diptera: Syrphidae) is one of the most speciose hoverflies genera with, at least, 170 species in the Palearctic region, having its highest diversity in the Mediterranean Basin. *Eumerus obliquus* (Fabricius, 1805) is the objective species of the present communication. This species is distributed, in the Palearctic region, across the Mediterranean basin and its distribution seems to be expanding inside this territory. Larvae have been cited feeding in decaying tissues of Opuntia, Aloe, cabbage, tropical fruit or potatoes. Despite there is some information about the life cycle of this species summarized by de Moor (1973), this is the first time that *E. obliquus* is reared under captive controlled conditions and that detailed biological and reproductive parameters such as developmental time, longevity, survival rate, rates of increase, fecundity or preoviposition time, among others, are provided.
These parameters were obtained after the analysis using the software "Age-stage, two-sex life table analysis" to take both sexes and the variable developmental rate among individuals and between sexes into consideration (Chi, 1988, 2019). For the analysis two hundred larvae were used and the larval longevity and mortality of everyone were recorded until their pupation. The pupae were isolated in Petri dishes until adult emergence and the adults were isolated in plastic containers for recording their longevity and fecundity.

References:

Chi, H. 1988. Life-table analysis incorporating both sexes and variable development rates among individuals. Environmental Entomology 17, 26-34

Chi, H. 2019. TWOSEX-MSChart: a computer program for the age-stage, two-sex life table analysis.

de Moor, F. C. (1973) Notes on a syrphid fly, *Eumerus obliquus* (Fabricius) (Diptera: Syrphidae). Arnoldia Rhodesia, 6: 1-7.

Keywords: *Eumerus*, two-sex life table, life cycle, captive rearing.

*Speaker

Poster N° 2

Preimaginal morphology of the European endemic species *Merodon triangulum* Vujić, Radenković & Hurkmans, 2020 of the *Merodon constans* group (Diptera: Syrphidae)

Andrea Aracil [1], Andrijana Andrić [2], Celeste Pérez-Bañón [1], Snežana Radenković [2], Ante Vujić [2], Santos Rojo [1]

[1] University of Alicante – Spain
[2] University of Novi Sad – Serbia

The genus *Merodon* Meigen, 1803 is one of the richest hoverfly genera, with around 180 species know species in the Palearctic region, with the highest species diversity recorded for the Mediterranean Basin. The larval biology of most *Merodon* species remain unknown, however, the development of all species which the preimaginal stages have been identified, occurs in bulbs of monocotyledonous plants of families Amaryllidaceae, Asparagaceae, Iridaceae and Liliaceae. The genus is classified into more than 20 monophyletic species (Vujic et al., 2021) groups being *Merodon triangulum* Vujic, Radenkovic & Hurkmans, 2020, belongs to the *constans* group and the *albifrons* lineage. It is a European endemic species, known from north-eastern Italy, northern Austria, eastern Hungary, Slovenia, Croatia, Serbia, Montenegro, and North Macedonia. The aim of this paper is to present the first data about preimaginal morphology (both larva and pupa) of this species, described using both optical microscopy and scanning electron microscopy (SEM). The larval description was obtained from wild larval specimens collected in Petrovaradinski rid, Novi Sad, Serbia, collected in June 2020, feeding inside bulbs of *Leucojum vernum* L. 1753 (Amaryllidaceae).

Keywords: *Merodon*, Serbia, preimaginal morphology, SEM

Poster N° 3

The importance of R4+5 vein shape in cryptic species delimitation - a case study of the *Merodon aureus* species complex (Diptera: Syrphidae)

Jelena Ačanski * [1], Ante Vujić [1] , Tamara Tot [1], Marija Miličić [1], Snežana Radenković [1]

[1] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Novi Sad – Serbia
[2] University of Novi Sad, BioSense Institute – Research Institute for Information Technologies in Biosystems, Novi Sad – Serbia

Cryptic species are morphogically indistinguishable but present genetically distinct lineages. To successfully distinguish them, it is necessary to apply integrative taxonomic approach, a combination of molecular, morphological, ecological and other relevant analyses. Within morphological analysis two approaches are in common use in hoverfly taxonomy: geometric morphometric analysis of wing and surstyle shape. Here, it is tested importance of R4+5 vein shape (one of the diagnostic character for genus *Merodon* Meigen, 1803) in cryptic species delimitation within *Merodon aureus* complex: *Merodon aureus* Fabricius, 1805, *Merodon calidus* Vujić, Ačanski et Šašić, 2019 and *Merodon ortus* Šašić Zorić, Ačanski et Vujić, 2019.
In order to quantify R4+5 vein shape, 20 semilandmarks were digitized along R4+5 vein from the intersection with r-m to the intersection with M1 veins. All three species were separated with high significance on the basis of R4+5 vein shape. Moreover, obtained results were in concordance with results of molecular (COI and 28S rRNA) and geometric morphometric analysis of the entire wing shape from Vujić et al. (2020).

Our results showed that R4+5 vein shape stand out as important character in *Merodon* cryptic species delimitation.

Vujić, A., Šašić Zorić, L., Ačanski, J., Likov, L., Radenković, S., Djan, M., Milić, D., Šebić, A., Ranković, M. and Khaghaninia, S. (2020): Hide-and-seek with hoverflies: *Merodon aureus*–a species, a complex or a subgroup? Zoological Journal of the Linnean Society, 190(3): 974-1001.

Keywords: cryptic species, geometric morphometrics, Merodon, R4+5 vein

*Corresponding author: acanski@biosense.rs

The GB Hoverfly Recording Scheme in a time of change

Stuart Ball * [1], Roger Morris† [1]

[1] Hoverfly Recording Scheme – United Kingdom

Since we last reported to this Symposium in 2011, a great deal has changed in the Hoverfly Recording Scheme's activities and in the state of British hoverflies. A big change was the establishment of a Facebook page in 2013. Prior to this, we received around 20-30,000 records per year, but few resulted from online posting. In each of the last two years we received more than 100,000 records, mostly from online postings. This has shifted the balance towards records of common and photogenic species, giving the impression that these have increased whilst the more obscure and difficult to identify have appeared to decline. This change challenges our ability to assess what is going on and has required new analytical techniques to account for evolving recorder behaviour.

These analyses suggests that around half of British species are in decline whilst less than 15% are increasing. The declines are most marked in the south-east where urbanisation and intensive agriculture are most prevalent. Some guilds are more affected than others, with wetland species being particularly hard hit. At the same time, new species continue to arrive from the Continent. We are also detecting changes in range, with some declines in the south-east being matched by expansion in the north-west and the northern boundaries of some species extending. Flight periods are also changing.

Given the ad hoc way in which our data is collected, it is difficult to assess the causes of these changes with any certainty. Habitat loss, widespread pollution and climate change are typically invoked. We can make no specific correlations, especially as the data relate to the presence of mobile adults rather than of larvae which, in many cases, will be far more niche-specific.

Keywords: British Hoverfly Recording Scheme, status change, range change, phenological change, photographic recording

*Speaker

†Corresponding author: syrphid58@gmail.com

Maps for "Hoverflies of NW Europe"

Stuart Ball * [1]

[1] Hoverfly Recording Scheme – United Kingdom

In 2019 Sander Bot and Frank Van de Meutter published "Veldgids Zweefvliegen" (Field Guide to Hoverflies of The Netherlands and Belgium) in Dutch. The publisher Bloomsbury requested that they produce an English version with an expanded geographical range – including Great Britain, Ireland, Denmark, Luxembourg and parts of western Germany and northern France. Sander and Frank approached Stuart Ball to help with the distribution maps and phenology plots. For this purpose, we combined data from the recording schemes in Belgium, Great Britain, Ireland and The Netherlands. Unfortunately, similar collations of detailed hoverfly records were not available for Denmark, Luxembourg and the regions of France and Germany to be covered. Up to date lists of the species present in these areas were assembled by Frank. In this talk I will describe some of the challenges arising from combining data collected in different formats, using different spatial reference systems and conforming to different checklists. I will illustrate the maps that were eventually produced, combining a more detailed analysis of the distribution and abundance of species from the areas covered by recording schemes with the presence/absence data for the remainder. I will also illustrate the phenology plots which contrast the flight period in Belgium and The Netherlands with that in the south-eastern and north-western British Isles.

Keywords: mapping, NW Europe

*Speaker

A range shift in *Leucozona glaucia* in Great Britain

Stuart Ball * [1], Roger Morris† [1]

[1] Hoverfly Recording Scheme – United Kingdom

Leucozonia glaucia is an easily identified hoverfly that commonly visits flowers, particularly Apiaceae, in Britain. Consequently, it is relatively well recorded. In recent years there have been noticeably fewer records from south-east England, although that is the most intensively recorded region. This led us to study its distribution and how it has changed over time. Three different methods were used: Mark Hill's FRESCALO, Species Distribution Modelling (mainly Maxent) and General Additive Models. Sufficient data was available for the years between 1980 and 2021, although it was only possible to use the period 1992 to 2018 for some analyses because this is the period for which ESA Landcover was available.

No overall trend is evident in the relative frequency with which the species has been recorded. There is, however, a clear trend for a decline in eastern and south-eastern England, whilst at the same time, it has expanded in the north and west – most noticeably in NW Scotland. The covariates that correlate best with these changes are derivatives of temperature and rainfall. This may be related to larval biology, which requires further study.

The ad hoc nature of the records makes it difficult to disentangle changes in the distribution and frequency of the animal from changes in recorder effort and behaviour. Recording effort is concentrated around population centres; the declines in eastern and south-east England are therefor likely to be genuine. However, the north-west is the least populated and most poorly recorded region, so it is more difficult to be certain whether changes there are real or are a consequence of the considerable increase in recording, especially photographic recording, that has occurred over the last decade.

Keywords: Leucozona glaucia, range change, Frescalo, Maxent, GAM, British Hoverfly Recording Scheme

*Speaker

†Corresponding author: syrphid58@gmail.com

Diversity of the Iberian *Cheilosia* Meigen (Diptera: Syrphidae), including new taxonomic findings for the genus

Iván Ballester-Torres * [1], Antonio Ricarte [1], Zorica Nedeljkoviić [1], Mª. Ángeles Marcos-García [1]

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

The high species diversity and the substantial levels of morphological similarity amongst species determine the great taxonomic complexity in the genus *Cheilosia* Meigen, 1838. With 57 species, *Cheilosia* is the hoverfly genus with the highest species richness in the Iberian Peninsula. Since Gil-Collado's monograph of the Spanish fauna of hoverflies, in 1930, there have not been further general studies dealing with the *Cheilosia* of this geographical region, apart from scattered works describing a few new species and adding distributional data on the faunas of certain peninsular areas. In this framework, the Iberian diversity of *Cheilosia* is currently under scrutiny, based on recent fieldwork in different Spanish ecosystems and revision of major entomological collections in terms of Iberian Syrphidae. We present here an updated overview of the knowledge of the Iberian *Cheilosia*, including the assessment of the validity of two new species, one allied with *Cheilosia melanura* (Becker, 1889) and other with *Cheilosia mutabilis* (Fallén, 1817). Morphology and molecular characters were studied for both species.

This research is part of Iván Ballester-Torres' PhD and belongs to the Fauna Ibérica project (PGC2018-095851-A-C65) of the Spanish Ministry of Science, Innovation and Universities, as well as to the UATALENTO17-08 of the "Vicerrectorado de Investigación y Transferencia del Conocimiento", University of Alicante.

Keywords: *Cheilosia*, Iberian Peninsula, *Cheilosia melanura*, *Cheilosia mutabilis*, new species

*Speaker

Syrphidae-decline evaluated after 43 years monitoring in a Dutch forest

Aat Barendregt * [1], Theo Zeegers , Wouter van Steenis † , Eelke Jongejans

[1] Independant Researcher – The Netherlands

Monitoring of hoverflies in a Dutch forest, surrounded by other forests, in the period 1979-2021 facilitates an evaluation of abundance and diversity in Syrphidae at this undisturbed location. Data collection (n=280) was standardised with a fixed route during most years in April-September. The mixed deciduous-conifer forest has an undergrowth of mainly *Vaccinium* and it is a representative of the dry forests with acidic soil in the region.

Between 1982 and 2021, total hoverfly abundance decreased by 80%. Until 1990, abundance showed a strong decrease of 10.9% per year, mainly in nationally rare species with carnivorous larvae exposed to air. From 1990, abundance stabilised, whereas from 2000 till 2021, a second period of strong decline of 9.0% per year occurred, this time mainly in very common species, also those with aquatic larvae.

Species richness also declined strongly between 1979 and 2021: the total number of species observed in five monitoring days dropped by 44% over those 43 years. The characteristic set of dry-forest hoverfly species (e.g. *Dasysyrphus, Parasyrphus, Chrysotoxum*) disappeared over four decades.

The number of nationally rare species observed at the study site declined from 19 to 9 early on, in a period (1979–1984) that coincided with intense nitrogen input and acidification caused by agriculture 5-30 km from this region. The more recent decline is likely also caused by factors from outside the forest, as forest management and conditions remained constant. Continued influx of nutrients and pesticides at a regional level, as well as climate change are possible causes of the decline.

Keywords: decreased diversity, defaunation, forest, insect decline

*Deceased
†Speaker

A revision of the hoverfly genera *Chrysogaster* and *Orthonevra* (Diptera: Syrphidae: Eristalinae) from the Afrotropical Region

Terence Bellingan * [1,2], John Midgley [3,4], Kurt Jordaens [5], Georg Goergen [6]

[1] Department of Entomology & Arachnology, Albany Museum, Makhanda, 6139 – South Africa
[2] Department of Zoology & Entomology, Rhodes University, Makhanda, 6139 – South Africa
[3] KwaZulu-Natal Museum, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa
[4] Department of Zoology & Entomology, Rhodes University, Makhanda, 6139 – South Africa
[5] Royal Museum for Central Africa, Joint Experimental Molecular Unit, Leuvensesteenweg 13, Tervuren – Belgium
[6] International Institute of Tropical Agriculture (IITA), Biodiversity Centre, 08 BP 0932 Tri Postal, Cotonou – Benin

Hoverflies (Diptera: Syrphidae) deliver important ecosystem services such as pollination, pest control and nutrient cycling. Currently, 62 genera of Syrphidae are known to the Afrotropical Region (*i.e.*, Africa, south of the Sahara). Despite the growing number of taxonomic studies, the taxonomic status of many hoverfly genera within the Afrotropical Region are not well known. The genera *Chrysogaster* Meigen, 1803 and *Orthonevra* Macquart, 1829 are good examples of this. In contrast to the better studied Palaearctic and Nearctic relatives, specimens of both genera are rare among museum collections and most species are only known from the type material. Our recent collecting efforts, however, have substantially increased the number of specimens, and the availability of fresh material allows the inclusion of molecular analysis in the study of the taxonomy of both genera. Here, we present the preliminary results of a taxonomic revision underway of both genera within the Afrotropical Region.

Keywords: Taxonomy, Africa, flower fly, pollinators

*Speaker

No significant effect of semi-natural habitats coverage or connectivity on Syrphid abundance and diversity in wildflower compensation areas.

David Bennett * [1]

[1] Christian-Albrechts Universität zu Kiel – Germany

Wildflower compensation areas (WCA) in agricultural ecosystems are becoming increasingly common methods to attempt to conserve wildlife in the landscape. However, little research has been done to determine what factors influence their effectiveness for insect conservation and ecosystem services.
In theory, the quantity of semi-natural habitat and the degree of habitat fragmentation may influence whether insects (including Syrphids) can colonise and utilise wildflower compensation areas. In summer 2021 we performed sampling at 37 WCAs across Schleswig Holstein, northern Germany with yellow pan traps. This was combined with high resolution spatial data on the quantity of semi natural habitats and modelling of habitat fragmentation (using the MESH and Connectance indexes).

Our 2021 results indicated a significant positive relationship between bee species richness and both semi-natural habitat percentage and the two fragmentation indices. We have not yet detected a significant relationship between semi-natural habitat or either habitat fragmentation metric for the richness or abundance of Syrphids (33 species detected across all WCAs). This could indicate that current WCA methods are too narrowly focused on bee conservation, or that the intense decline of Syrphid species in Germany observed in prior studies limits the current usefuless of the WCAs.
We are repeating and expanding the study in summer 2022, and we will also implement an eDNA method for detecting insects visiting wildflower heads (following a successful prototype last year).

Keywords: Wildflower compensation areas, Syrphidae, habitat fragmentation, eDNA, landscape scale conservation

*Speaker

The genus *Cheilosia* Meigen (Diptera: Syrphidae) in the Caucasus with the description of eleven new species

Sander Bot * [1], Ximo Mengual , Frank Van de Meutter , Jeffrey Skevington

[1] Kerklaan 30E, NL-9751 NN, Haren – The Netherlands

Cheilosia Meigen, 1822 is a species rich genus with some 420 described species. The greatest number of species occurs in in the Palaearctic Region (Peck 1988; Thompson 2021; S. Bot, unpubl. data). The Caucasus Region lies between the Black Sea and the Caspian Sea. The region is home to the Caucasus Mountains and is one of the global 'biodiversity hotspots' (Myers *et al.* 2000; Mittermeier *et al.* 2004). Work on *Cheilosia* in the Caucasus was mainly conducted by Russian authors and was summarized by Barkalov (1993). A checklist and a species key of the *Cheilosia* of the Caucasus is presented, based on literature research and the results from four field expeditions between 2018 and 2021. The field expeditions and genetic analysis resulted in the discovery of eleven new species, new synonyms and revalidation of old names. While the previous checklist for the region (Barkalov 1993) included 48 *Cheilosia* species, our current checklist of the *Cheilosia* of the Caucasus comprises 66 species. Taxonomic changes in the meantime make exact comparison of the lists difficult, but the increase of the list is mainly explained by the description of eleven new species in this publication and the discovery of several species new to the region during our field expeditions.

Expeditions in 2018 and 2019 have been funded through the German Federal Ministry of Education and Research (BMBF) under grant number 01DK17048, within the GGBC project aimed at establishing a Georgian-German Biodiversity Center co-operated by Ilia State University (ISU) and Zoological Research Museum A. Koenig (ZFMK).

Keywords: Caucasus, *Cheilosia*, new species

*Speaker

Photographing European hoverflies (Diptera: Syrphidae) as part of the Taxo-Fly project

Sander Bot * [1], Ana Grković [2], Laura Likov [3] , Tamara Tot [3], Ante Vujić [2,3], Gunilla Ståhls [4]

[1] Kerklaan 30E, NL-9751 NN, Haren – The Netherlands
[2] University of Novi Sad – Serbia
[3] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology – Serbia
[4] University of Helsinki, Finnish Museum of Natural History, Helsinki – Finland

Taxo-Fly is a three-year project commissioned by the European Commission (EC) to develop resources for European hoverfly inventory and taxonomy. The overall objective of Taxo-Fly is to create a new taxonomic knowledge base, which lays the ground for the identification of the hoverflies of Europe. This taxonomic information will be easily available and accessible, usable by researchers as well as citizen scientists. For this purpose, a web platform will be built. High-quality images of all European hoverfly species are an important part of this platform. Within the core team of Taxo-Fly, the photography team has the task to produce these images. As a base, the photographs of the Dutch field guide (Bot & Van de Meutter 2019) will be used. The remaining images will be produced during the project using two photography setups, one in The Netherlands and one at the University of Novi Sad. The setup consists of a Canon EOS 6D body and a set of lenses and flashes. With help of the photo editing software programs standardized high-quality photographs will be created. For every species the male imago will be photographed dorsally and several additional detailed images will be produced to highlight important identification features. This will lead to three to up to ca. eight images per species, depending on the difficulty of identification of the species. For male genitalia photographs are less suitable and line drawings will be used instead. To create high-quality images fresh and correctly pinned material is necessary. There will be extensive Europe-wide collecting in 2022 and 2023 to get as many fresh and correctly pinned species as possible. Your help will be appreciated in the 2023 collecting season to obtain fresh material of the missing species. If for species no fresh material can be collected, collection material will be used instead.

Keywords: Taxo, Fly, photography, taxonomy

*Speaker

Poster N° 4

Hoverfly (Diptera: Syrphidae) abundance in sunflower fields in the Lehau region of Limpopo province, South Africa

Xavier Brits [1], Hannelie Human [1], John Midgley [2,3], Christopher Weldon [1]

[1] Department of Zoology and Entomology [Pretoria] – South Africa
[2] Department of Zoology and Entomology, Rhodes University, Makhanda, 6139 – South Africa
[3] KwaZulu-Natal Museum, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa

Sunflowers are an important crop in South Africa, accounting for _~4.5% of the annual agricultural production value. While sunflowers are not reliant on external pollinators for seed set, self-fertilization results in reduced yield. Most sunflower farms in South Africa rely on wild pollinators for this service, but the dynamics of these pollinators is poorly known. Five sunflower fields were selected in the Lehau region of the Limpopo Province, South Africa, ranging in size from 4.3 to 19 ha. At each field, four plots were selected, one 50m outside the field, one 5m outside, one 5m inside and one 50m inside. Each field was sampled once per growth phase. Each plot was sampled with a sweep net for 30 minutes in the morning, the middle of the day and evening in a random pattern. Hoverflies were most abundant during the active flowering phase and were most abundant at the edges of the fields, followed by within the field and least abundant outside of the fields. Hoverflies appear to show a preference for sunflower fields over the general environment and were most abundant during the peak flowering season. The observed population dynamics suggests that hoverflies utilize sunflower fields and could be pollinators of sunflowers. Future work is also discussed.

Keywords: Agriculture, pollinators, habitat use

Vulnerability of subalpine habitats to climate change: the case of Diptera syrphidae in the Hauts de Chartreuses National Nature Reserve (Isère, 38) between 2008 and 2020

Jocelyn Claude *† [1,2], Romain Decoin [2], Bruno Tissot [2], Martin C.D. Speight [3], Emmanuel Castella [4], Suzanne Forêt [5]

[1] Independant entomologist, 15 rue du Bief, 71460, Cormatin – France
[2] Amis de la Réserve Naturelle du lac de Remoray, Maison de la Réserve, 25160 Labergement-Sainte-Marie – France
[3] Dept. of Zoology, Trinity College, Dublin 2 – Ireland
[4] Département F.-A. Forel des Sciences de l'Environnement et de l'Eau, Université de Genève, Boulevard Carl-Vogt 66, CH-1205 Genève – Switzerland
[5] Réserve Naturelle des Hauts de Chartreuse, Maison du Parc, 38380 Saint Pierre de Chartreuse – France

As part of the management plan for the Hauts de Chartreuse National Nature Reserve, a second study on syrphid diptera is being carried out in 2019 and 2020 on two sectors, first studied in 2008. The aim was to measure the evolution of the ecological status of these high-altitude habitats (mainly subalpine grasslands and pine forests) since 2008.
A decrease in hoverflies has been observed (-16% of total abundance; -7% of species richness) between 2008 and 2020. The data were processed using the Syrph the Net expert system, which made it possible to compare, for each habitat, the observed hoverfly stand compared to an expected stand. Particular attention was paid to the evolution of the processions since 2008.

The lawns and subalpine moors of Mont Granier seem to be of limited ecological integrity and have recorded a decrease in ecological integrity of -21% since 2008, a probable consequence of a loss of floristic typicity. At the Dent de Crolles this type of habitat has changed very little during the decade and maintains good ecological integrity.

In spite of good results in 2019-2020, the Pine forests also show a decrease in functionality, down to -32% at Mont Granier. The diagnosis points above all to a dysfunction in forest recruitment (Pines and accompanying species).
Climate change could be at the origin of this degradation. The increase in the proportions of unexpected species with mountain or even hillside ecological affinities supports this hypothesis. Several monitoring studies (meteorology, botany) are proposed to better understand the disturbances identified during this study.

Keywords: Hoverflies, bioindicator, ecological integrity, unimproved subalpine grassland, *Pinus* Forest

*Speaker
†Corresponding author: jocelyn.claude@espaces-naturels.fr

Hoverflies as mimics of the Oriental hornet (*Vespa orientalis*)

Klára Daňková *† [1], Antonín Hlaváček [1], Daniel Benda [1,2], Petr Bogusch [3], Jiří Hadrava [1,4]

[1] Department of Zoology, Faculty of Science, Charles University, Viničná 7, CZ-12844 Praha 2 – Czech Republic
[2] Department of Entomology, National Museum, Cirkusová 1740, CZ-19300 Praha 9 – Czech Republic
[3] Faculty of Science, University of Hradec Králové, Rokitanského 62, CZ-50003 Hradec Králové – Czech Republic
[4] Institute of Entomology, Biological Centre, Czech Academy of Science, Branišovská 31, CZ-37005 České Budějovice – Czech Republic

Despite potent defence and ecological generalism of hornets (*Vespa* spp.), little attention has been paid to them as potential models of mimicry in hoverflies. We propose a Batesian-Müllerian mimicry ring of the Oriental hornet (*Vespa orientalis*) consisting of eight species that coexist in the Mediterranean region, including two hoverfly species (*Volucella zonaria* and *Milesia crabroniformis*), one thick-headed fly (Diptera: Conopidae) and five hymenopterans. To reveal general ecological patterns, we compared their phenology and geographical distribution. The Batesian mimics occurred later during a season than the Müllerian mimics, which corresponds to the model-first theory that predicts earlier appearance of models than mimics. In *Volucella zonaria* (Diptera: Syrphidae), its temperature-driven range expansion could lead to allopatry with its original model, and, potentially, to less accurate resemblance to an alternative model, the European hornet (*Vespa crabro*). Sympatry with an alternative model, the European hornet, probably also leads to colour polymorphism in some hymenopteran members of the mimicry ring. We further encourage using this mimicry ring as a suitable model system for studying general patterns of evolution of mimicry in heterogeneous and temporally dynamic environments.

Keywords: mimicry, biogeography, phenology, polymorphism, *Volucella*, *Milesia*

*Speaker
†Corresponding author: klara.dankova@atlas.cz

Poster N° 5

Database of DNA barcodes of hoverflies in Serbia– essential tool for environmental DNA survey

Mihajla Djan [1], Nataša Kočiš Tubić [1], Tamara Tot [1], Ljiljana Šašić Zorić [2], Iva Gorše [1], Ante Vujić [1], Snežana Radenković [1]

[1] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Trg Dositeja Obradovića 2, 21000 Novi Sad – Serbia
[2] University of Novi Sad, BioSense Institute – Research Institute for Information Technologies in Biosystems, Novi Sad – Serbia

A new and common approach in invertebrate taxa detection includes environmental DNA (eDNA) metabarcoding of a fragment of mitochondrial cytochrome c oxidase I gene (COI), using PCR primers designed to target metazoans. This fragment overlaps with DNA barcode fragment (Folmer et al., 1994, Mol Mar Biol Biotechnol. 3:294-9), which is the most used primer pair for amplification of DNA barcodes in many animals, including hoverflies. However, the identification of taxa in eDNA samples to species level depends on existing databases. In our recent research during field work conducted in May and June 2022, in total, 90 soil samples were collected and eDNA was extracted. Sampling design included two soil types typical for Vojvodina Province (Republic of Serbia), each represented by three localities. At each locality two agricultural and one natural habitat were selected and at each five replicates were sampled. MtCOI was successfully amplified. Simultaneously, during field work within Serbian Pollinator Advice Strategy (SPAS) Project in a period from April 2022 to June 2022, in the same area, 41 hoverfly species belonging to 21 genera were registered. In order to explore the potential of eDNA metabarcoding for hoverfly species detection in agricultural and natural habitats of Vojvodina Province using eDNA metabarcoding, we did search of NCBI Nucleotide database (`https://www.ncbi.nlm.nih.gov/`) and BOLD System v4 database (`https://boldsystems.org/index.php`). No DNA barcodes in databases were found for four registered species in the area (9.8%): *Cheilosia griseifacies* Vujić, 1994, *Meligramma euchroma* Kowarz, 1885, *Neoascia interrupta* Meigen, 1822 and *Pocota personata* Harris, 1780. In addition, DNA barcodes of only nine registered species (21.9%) from specimens from the same geographical area are present in databases. Thus, in order to increase the resolution of eDNA survey in hoverfly identification, our first step conducted is DNA barcoding of all registered hoverfly species missing DNA barcodes to enrich DNA databases.

Acknowledgements
This research was supported by the Provincial Secretariat for Higher Education and Scientific Research of Autonomous Province of Vojvodina (Project title: *Environmental DNA – biomarker of soil quality in Vojvodina; Grant No. 142–451–2610/2021-1/2*), the Science Fund of the Republic of Serbia, *Grant No. 7737504, Serbian Pollinator Advice Strategy – for the next normal – SPAS* and the Ministry of Education, Science and Technological Development of the Republic of Serbia, *Grant No.451-03-68/2022-14/200125.*
Keywords: mtCOI gene, hoverflies, Serbia, eDNA

Larval development and voracity of *Eupeodes americanus* (Diptera: Syrphidae): comparison of the focal prey, *Aphis gossypii* (Hemiptera: Aphididae) and the banker prey, *Rhopalosiphum padi* (Hemiptera: Aphididae)

Arlette Fauteux * [1], António Soares [2], Eric Lucas [1]

[1] University of Québec in Montréal (UQAM) – Biological control laboratory, Department of Biological Sciences, University of Québec in Montréal (UQAM), P.O. Box 8888, Downtown Branch, Montréal, Québec – Canada

[2] University of the Azores – Centre for Ecology, Evolution and Environmental Changes and Azorean Biodiversity Group, Faculty of Sciences and Technology, University of the Azores, 9501-321 Ponta Delgada – Portugal

Unlike European species, the potential of Nearctic syrphid species as biological control agents is still poorly studied. Nonetheless, the American Hoverfly (*Eupeodes americanus* Wiedemann 1830) has recently demonstrated promising results as a biological control agent, notably against the foxglove aphid (*Aulacorthum solani* Kaltenbach 1843) on pepper. The present study aims to extend our knowledge of the American Hoverfly, and more specifically to evaluate its potential as a biocontrol agent in a banker plant system, against the melon aphid (*Aphis gossypii* Glover 1877) in greenhouse cucumber crop. In banker plant systems, the success of the biocontrol is clearly linked to the voracity of the predator on the banker prey and the focal prey (pest) and to the respective values of both preys for the development of the predator. Consequently, the preimaginal development and voracity of *E. americanus* were compared when preying upon the focal prey (melon aphid, *A. gossypii*) or the banker prey (bird cherry-oat aphid, *Rhopalosiphum padi* L. 1758) by the daily observation of larvae from egg to adult emergence (25∘C, 16 L:8 D photoperiod and 50% R.H). Development of the larvae was similar on both prey species, except for 3rd instar and pupal weight that were higher for larvae fed with the banker prey. The *ad libitum* voracity was similar on both preys except for the third instar larva which consumed more focal preys. Results suggest that a banker plant system involving the bird cherry-oat aphid could be adequate for *E. americanus* to efficiently control the melon aphid.

Keywords: American hoverfly, biological control, banker plant system, melon aphid, bird cherry-oat aphid, greenhouse cucumber.

*Speaker

Syrphin' Switzerland: aims and achievements of a recent Syrphidae project in the country

Lisa Fisler *† [1]

[1] Info fauna – Switzerland

Switzerland benefits from a public institution, Info fauna, which oversees the collection and distribution of faunistic data, collaborates to ensure the conservation of the swiss fauna and generally participates and encourages projects that aim to widen up the access to faunistic and conservation data.
In this scope a new project started at the beginning of 2020 with the objective to expand and spread knowledge on a little-known group in the country: Syrphidae. This group was also chosen because of its evident value in bioindication as well as the ecological services it provides.

This project had three goals. First, to ensure that ecological knowledge would be freely and easily accessible on info fauna's platform for all the swiss species. Second, to enable their identification through already existing keys, and by the creation of two new genera keys for which no European identification tool comprised all the swiss species (*Cheilosia* and *Platycheirus*). And finally, with the aid of targeted samplings, to broaden the already available habitat-species association knowledge (in the Syrph the Net database), with four valuable habitats in the country.

This project is now coming to an end, and will benefit researchers and amateurs alike, even beyond our borders. We hope that the tools we created will foster new Syrphidae projects in the country that will in turn contribute to increase the knowledge on this taxon.
In this presentation, the details of each part of the project will be explored. Along with the results, different aspects of their creation will be discussed with potential prospects for future updates and extensions.

*Speaker
†Corresponding author: lisa.fisler@infofauna.ch

Poster N° 6

Hoverflies (Diptera: Syrphidae) of the Bolle di Magadino - Biodiversity and habitat assessment using the Syrph the Net method

Isabella Forini-Giacalone * [1], Lucia Pollini Paltrinieri [2], Bärbel Koch [2]

[1] Independant Researcher, Monte Carasso – Switzerland
[2] Museo cantonale di storia naturale, Lugano – Switzerland

Since 2018, the "Working Group Sirfidi Ticino" has promoted a series of research on Syrphidae (Diptera) in the southern region of the Swiss Alps (Canton Ticino) applying the Syrph the Net (StN) methodology. One of these researches investigated wet habitats of the natural reserve of the Bolle di Magadino located on the delta of rivers that flow into the lake Lago Maggiore. Hoverflies were sampled with 6 Malaise traps at three survey sites between April 2018 and May 2019. During this period, we found 2130 specimens belonging to 66 hoverfly species, almost a quarter of the syrphid fauna known so far for Ticino with 17 species classified as threatened or declining at European and/or Swiss level. The low specific biodiversity was an expected result, as wetland involves less diversified but specialized and characteristic communities.

StN analyses showed an overall low functional integrity of 38% due, among other things, to the compromised alluvial dynamics of the rivers and the lake dam. In general, forest habitats have medium-low integrity (young age of the forests due to past management), while marsh and grassland habitats have generally good integrity. Habitats with the most complete hoverfly community were tall sedge beds/cane bed (100%) and alluvial lowland unimproved grassland (70%), while the worst results were obtained for fen carr habitat (34%) and alluvial forest with *Quercus*, *Ulmus*, *Fraxinus* (37%). However, the richness of the reserve lies in the mosaic of diversified habitats and structures such as forests, wetlands and grasslands, sand dunes, ruderal spaces, lake shores, streams and bodies of water of different types. The wooded environments reflects the presence of particular and unique forest associations in the region, such as Salicion albae and Alno-Fraxinion alliance and play an important role as a reservoir for most of the expected species.

Keywords: Biodiversity, Switzerland, Syrph the Net.

*Corresponding author: isa.forini@gmail.com

Interactive keys, a useful approach to applied aspect of taxonomy

Babak Gharali *† [1]

[1] Agricultural Research,Education and Extension Organization (AREEO) – Iran

The construction of keys is one of the primary functional aspects of taxonomy. The most common identification keys are dichotomous or pictorial keys. With the development of modern computer systems and photographic techniques, keys made by human-computer interaction, known as interactive keys, are continuously and rapidly expanding. These keys have numerous advantages, e.g., flexibility in choosing taxonomic features (useful in partly damaged specimens), error tolerance, the ability to provide uniform descriptions in review articles, the ability to provide an unlimited number of photos or information in separate pages (html) of features or whole taxa, virtual training without a physical specimen, availability of free key making software on the net, the ability to load on smartphones, easy to build keys (without the need for programming knowledge). Here is an overview of interactive key histories, available software and comparison of different aspects of key maker software, the principles of key making, examples of keys made for insects (especially Diptera), and the benefits and problems of the software are discussed; and, at the end, the need to make keys for the genera of Syrphidae in the Palaearctic and the genera such as *Eumerus* is presented.

Keywords: Taxonomy, key, interactive key, Syrphidae

*Speaker
†Corresponding author: bgharaei@mail.com

Impact of different banker plant systems on the oviposition preferences of the American hoverfly, Eupeodes americanus

Noémie Gonzalez *† [1], Arlette Fauteux [1], Jean-Christophe Louis [1], Rose Buitenhuis [2], Eric Lucas [1]

[1] Laboratoire de Lutte Biologique, Département des Sciences Biologiques, Université du Québec à Montréal (UQAM) – CP 8888, succursale Centre-Ville, Montréal (Québec, Canada) H3C 3P8 – Canada
[2] Vineland Research and Innovation Centre – 4890 Victoria Ave. N., Box 4000, Vineland Station (Ontario, Canada) L0R 2E0 – Canada

Assessing the oviposition preferences of hoverflies is essential to predict the success of this biological control agent against aphids in greenhouses, especially when using banker plant systems or for greenhouses with mixed crops. In this study, the oviposition preferences of the American hoverfly, *Eupeodes Americanus* Wiedemann, 1830 (Diptera: Syrphidae) were evaluated in choice experiments with different plant/aphid systems. Female oviposition choices were evaluated in two contexts: 1) choice between banker plants and focal crops and 2) choice in mixed crops. The results showed that in cucumber crops, the species of banker plant drastically influences the oviposition preferences of the hoverfly. Barley banker plants were preferred over cucumber, while the opposite was observed for finger millet. Females had no preference between cucumber and corn banker plants. The preference for barley banker plants was not observed in a sweet pepper crop. In mixed crops, the American hoverfly has no preference between cucumber and pepper, which means they should be able to protect both crops. This study shows that the choice of the banker plant system according to the crops/aphids present in the greenhouse greatly affects the female oviposition preferences and consequently the success of a biocontrol program. It also confirms the potential of the American hoverfly as a generalist predator in multiple greenhouse contexts.

Keywords: Aphidophagous hoverfly, Syphidae, Oviposition behavior, Banker prey, Focal prey

*Speaker
†Corresponding author: gonzalez.noemie@courrier.uqam.ca

Poster N° 7

Spatial patterns of COI haplotype diversity in response to environmental factors – case study on *Merodon aerarius* (Diptera: Syrphidae)

Iva Gorše * [1], Ljiljana Šašić Zorić [2], Marija Miličić [2], Mihajla Djan [1], Gunilla Ståhls [3], Ante Vujić [1]

[1] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Novi Sad – Serbia
[2] University of Novi Sad, BioSense Institute – Research Institute for Information Technologies in Biosystems, Novi Sad – Serbia
[3] University of Helsinki, Finnish Museum of Natural History, Helsinki – Finland

Understanding the processes responsible for shaping the spatial genetic patterns and distribution of species is critical for predicting evolutionary dynamics and defining significant management units. Here, we aim to obtain insight into environmental factors contributing to the dispersion and mitochondrial genetic structuring of *Merodon aerarius* - a widespread hoverfly species present on the mountain ranges of central Europe and the Balkan Peninsula, as well as on the islands of Sardinia and Corsica, as well as to establish its current potential distribution. In this regard, we assayed genetic variation at 5'COI gene sequences in 97 specimens of *M. aerarius* collected from 30 sites throughout its range. A Median-joining network of haplotypes was constructed employing the software PopART. Species distribution modelling using MAXENT algorithm was used in order to establish current potential distribution of *M. aerarius*, while the DISTLM routine implemented in PERMANOVA+ was performed to examine the association between distribution of haplotypes and environmental variables. A total of 19 haplotypes were obtained from our dataset, whereby the pattern of Median-joining network indicated grouping of haplotypes from the related sampling areas. The association between environmental and genetic variation revealed that 7 environmental/geospatial variables (LON, LAT, bio2, bio4, bio13, bio15, bio18) had statistically significant role in shaping the spatial patterns of haplotype distribution. This study highlights the utility of landscape studies to better understand the processes shaping geographic patterns of genetic diversity and distribution of hoverflies.

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Keywords: DNA barcode, haplotype distribution modelling, hoverflies, species distribution modelling

*Corresponding author: iva.gorse@dbe.uns.ac.rs

Poster N° 8

Species relationships in the genus *Eumerus* (Diptera: Syrphidae) based on morphological evidence

Ana Grković [1], Jelena Ačanski [2], Tamara Tot [3], Ante Vujić [1], Snežana Radenković [1]

[1] University of Novi Sad – Serbia
[2] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Novi Sad, Serbia – Serbia
[3] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology – Serbia

Within the family Syrphidae, quantitative phylogenetic methods have been used on both morphological and molecular data (Rotheray and Gilbert, 1999; Cheng et al, 2000; Ståhls et al, 2003; Hippa and Ståhls, 2005; Doczkal and Pape, 2009; Mengual et al, 2015), but most researchers have used non-numerical qualitative methods to assess morphological data. Here we present the first numerical analysis of systematic relationships of the genus *Eumerus* from Southeast Europe using a comprehensive morphological character matrix. We scored 189 adult morphological characters for 44 species recorded in South Europe.
Principal component analysis (PCA) identified 49 PC axes, of which 24 axes were selected based on the percentage of variability. The following morphological characters stood out as the most significant for *Eumerus* delimitation: (1) the arrangement of pilosity on the katepisternum, (2) uniformity of ventral pilosity on hind femur in male, (3) the arrangement of dusting on the katepisternum, (4) the shape of hamus, (5) the distance between the posterior ocellus and the eye margin in female, (6) furrowing of the female basoflagellomere and (7) the shape of cercus. Moreover, the species position in the space defined by morphological characters is depicted using PCA scatterplots. Finally, with cluster analysis based on Euclidean distances we provided (NJ) phenogram in order to test the efficiency of a set of morphological characters for systematics within the genus. The phenogram recognized the major three clusters: (1) outgroup (genera *Merodon, Platynochetus* and *Megatrigon*) clustered together with *Eumerus tricolor* group species, (2) *Eumerus ornatus* group and (3) all other species clustered together.

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Keywords: Morphological matrix, Principal component analysis, *Eumerus*, Syrphidae, Phenogram

On generalist pollinators and the role of hoverflies in communities of pollinators.

Jiří Hadrava * [1,2], Zdeněk Janovský [1], Jakub Štenc [3], Jan Klečka [2]

[1] Department of Zoology, Faculty of Science, Charles University – Czech Republic
[2] Institute of Entomology, Czech Academy of Science – Czech Republic
[3] Department of Botany, Faculty of Science, Charles University – Czech Republic

Hoverflies, similarly as other groups of Diptera: are supposed to be rather generalist and opportunistic pollinators. Consequently, they are usually assumed to be less effective than other groups of pollinators, such as highly specialised bees which are more likely to transfer pollen between conspecific flowers. However, even generalised pollinators have floral preferences, apparent particularly at limited spatio-temporal scales. Hence, they could provide similar quality of pollination as specialised pollinators do. Moreover, generalist pollinators may be even more beneficial for plant communities than the specialised ones as they are more flexible according to the community context and they could pollinate plants that miss other pollinators.
Here, we present results from several experiments aiming to reveal the role of hoverflies in communities of plants and their pollinators. We found that hoverflies visit different spectrum of plants than other generalist pollinators and they are choosing flowers using different floral traits than other pollinators. We also found that there is a huge variability between species of hoverflies in their floral preferences: wihle Eristalinae species have rather strong preferences for certain floral traits, Syrphinae are rather generalists in the narrow sense and they visit mainly those flowers that are overlooked by other pollinators.

Keywords: Pollination, generalised pollinators, floral preferences, hoverflies

*Speaker

The most remarkable of migrants - four years of insect migration monitoring at a Pyrenean Mountain pass

Will Hawkes * [1], Toby Doyle [1], Scarlett Weston [1], Kelsey Davies [1], Richard Massy [1], Karl Wotton [1]

[1] College of Life and Environmental Sciences, Exeter – United Kingdom

The Puerto de Bujaruelo mountain pass, situated above Gavarnie at 2275 m, has been the location of insect migration research for over 70 years. In the 1950s Lack & Lack (1951) and Williams *et al.* (1956) recorded large numbers of insects from many different Orders migrating through the pass. However, between 1956 and 2018 no published monitoring of insect migration was performed at the pass. We present four years of intensive insect migration monitoring for the Autumn seasons of 2018-2021, the first whole insect assemblage study performed in the area during the migration season. Using modern technology, we were able to quantify for the first time the number of insects moving through the pass, as well as utilising continued trapping efforts to obtain a representative checklist of the migratory species. We found that millions of insects traverse the pass every year, with hoverflies making up a large percentage of the assemblage. We also show that the assemblage of migratory insects is diverse in the area and even the tiniest of Diptera show strong migratory behaviour. Coupled with fascinating research into the migratory behaviour of hoverfly migration from my friend and PhD colleague Richard Massy, this talk will showcase the fascinating world of insect migration which occurs during the Autumn in the Pyrenees.

Keywords: Migration, Discovery, Insects, Monitoring

*Speaker

Behavioural strategies of two *Eristalis* species - observations in the pandemic year

Jonathan Heal * [1]

[1] Independent Researcher, Stone, Staffordshire – United Kingdom

The pandemic year of 2020 provided a unique opportunity to observe the behavioural strategies of two species of *Eristalis.* Although constrained by the pandemic to spend a lot of time at home, the unusually fine weather brought insect ecology to my garden, and the great reduction in car traffic on the roads allowed visits from many more insect species.

From mid-March to May I had daily visits from *Eristalis pertinax*, mostly males which chose an open part of the garden for hovering, and on some days hovering continued for several hours into the afternoon.

From May through till Autumn, the most regular hoverfly was *E. tenax,* males of which often appeared early in the morning, as soon as the flower beds received direct sunshine. In this species, mate searching behaviour was mostly seen early in the day, presumably because there was a need to find recently emerged and unmated females.

Males of *E. pertinax* appeared later in the day. Many hours of observation showed no sign of "territorial" behaviour. The hovering is not at one fixed point in space, but the males would drift, turn, dart and switch positions every few seconds.

Although *Eristalis* normally fly quietly, a slow buzzing flight is used by female *E. pertinax* around possible sites for oviposition, and by female *E. tenax* flying indoors when hibernation sites are needed.

It was my good fortune that some female *E. pertinax* chose to scatter eggs around the top of a kitchen drain, from which a small brood was reared.

Keywords: *Eristalis* hovering mate searching

*Speaker

The autumnal migration of hoverflies with special focus on sex ratio and timing of migration

Antonín Hlaváček * [1], Radek Lučan [1], Jiří Hadrava [1]

[1] Charles University in Prague, Faculty of Science, Department of Zoology – Czech Republic

We report four years-long observations of hoverflies' autumnal migration. Our study focused on species composition, phenology, and sex ratio of migrants. Two one-side-blocked Malaise traps were set from August to November annually since 2018. We recorded 31 species of migrating hoverflies. The timing of migration varied between seasons and species; larger hoverflies migrated earlier than the smaller ones. Moreover, the sex ratio of the four most common migrants (*Episyrphus balteatus*, *Eupeodes corollae*, *Melanostoma mellinum*, and *Sphaerophoria scripta*) differed. Female biased sex ratio was observed consistently in *Sphaerophoria scripta* and in one season in *Episyrphus balteatus*. Male biased sex ratio was observed in one season in *Eupeodes corollae*. In *Melanostoma mellinum* was the sex ratio consistently balanced, see Figure. Drivers of interspecific differences in the timing of migration and sex ratio are discussed regarding morphological and ecological traits of the species.

Keywords: migration, phenology, sex ratio

*Speaker

The attractiveness of alternative crops in agricultural landscapes on local hoverfly populations

Adrian Jaich *† [1], Melanie Wohlrab [2], Annette Herz [1]

[1] Julius Kühn-Institute for Biological Control, Dossenheim – Germany
[2] Technische Universität Darmstadt – Germany

For sustainable and insect-friendly agriculture, various measures such as the establishment of flower strips or reduction of pesticides are important to increase insect abundance. However, the selection and cultivation of the crops themselves and a higher diversification can also have a direct impact on the development of local insect populations. With flowering crops, farmers can provide important alternative food sources for flower visitors such as bees and hoverflies. Hoverflies, in particular, as important natural enemies in biological control, rely on nectar and pollen in the adult stage. In an experimental field trial, the attractiveness of different flowering crops was investigated.

For this purpose, 22 different species of renewable energy, medicinal or dyeing plants were selected and grown in small plots. The plants selected were anise (*Pimpinella anisum*), buckwheat (*Fagopyrum esculentum*), camelina (*Camelina sativa*), caraway (*Carum carvi*), chamomile (*Matricaria chamomilla*), common chicory (*Cichorium intybus*), coriander (*Coriandrum sativum*), cup plant (*Silphium perfoliatum*), dyer's chamomile (*Anthemis tinctoria*), common poppy (*Papaver rhoeas*), dyer's weed (*Reseda luteola*), Ethiopian rapeseed (*Brassica carinata*), fennel (*Foeniculum vulgare*), flax (*Linum usitatissimum*), madder (*Rubia tinctorum*), mugwort (*Artemisia vulgaris*), phacelia (*Phacelia tanacetifolia*), rose madder (*Rubia tinctorum*), safflower (*Carthamus tinctorius*), sweet alyssum (*Lobularia maritima*), valerian (*Valeriana officinalis*) and woad (*Isatis tinctoria*). To determine if a plant was attractive, the flowers were observed twice daily (morning and noon) for eight minutes each on three days per week, and all perceived and detectable visitors on the flowers were noted. The results showed the attractiveness of the plants to hoverflies and other insects (Hymenoptera, Lepidoptera, Coleoptera, Heteroptera, and other Diptera). Buckwheat, coriander, and chamomile were particularly attractive to hoverflies, while flax and other tested plants were visited little or not at all. The objective of this research is to identify plants that could be of benefit to farmers while providing an expanded food supply for insects.

This study is being conducted as part of the FInAL project (`https://www.final-projekt.de/en/`).

*Speaker
†Corresponding author: adrian.jaich@julius-kuehn.de

Newly designated hoverfly (Diptera: Syrphidae) species of conservation concern and Prime Hoverfly Areas in Serbia

Marina Janković Milosavljević *† [1], Marija Miličić [2], Snežana Popov [1], Ante Vujić [1]

[1] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Trg Dositeja Obradovića 2, 21000 Novi Sad – Serbia
[2] University of Novi Sad, BioSense Institute – Research Institute for Information Technologies in Biosystems, Dr Zorana Đinđića 1, 21000 Novi Sad – Serbia

Due to limited resources for conservation purposes, conservation efforts have to be precisely directed in a way that would ensure the protection of as many imperilled species as possible. To be able to do that, it is necessary to implement systematic sampling as a basis for conservation. Building on the work of Vujić et al. (2016), in the period from 2016. to 2018, systematic sampling of hoverflies on designated localities on the territory of Republic of Serbia was conducted. The aim of this study was to designate new species of conservation concern (PHA species) and additional Prime Hoverfly Areas (PHAs), based on the new records from recent field work. Methodology of Vujić et al. (2016) was followed, species or area had to meet at least one of the criteria in order to be denoted as PHA species or area. According to our results, 16 species met the requirements to be marked as PHA species, while seven areas met the criteria to be designated as PHAs. Additionally, designated areas where overlapped with Protected Areas, Prime Butterfly Areas and Important Bird Areas to determine the percentage of overlapping between new PHAs and areas which have some form of recognition and/or protection in Serbia. Results of this study can significantly contribute in planning future monitoring activities and creating conservation strategy for the preservation of important hoverfly species in Serbia. They also represent a solid foundation for alteration or expansion of legislative concerning this insect group.

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Acknowledgements

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Keywords: Syrphidae, species conservation, key areas

*Speaker
†Corresponding author: marinaj@dbe.uns.ac.rs

Poster N° 9

The Diversity of Pollinating Diptera in South African biodiversity hotspots (DIPoDIP) project

Kurt Jordaens * [1], Terence Bellingan [2,3], John Midgley [2,4], Marc De Meyer [1]

[1] Royal Museum for Central Africa, Invertebrates Section, Leuvensesteenweg 13, 3080 Tervuren – Belgium
[2] Department of Zoology & Entomology, Rhodes University, Makhanda, 6139 – South Africa
[3] Department of Entomology & Arachnology, Albany Museum, Makhanda, 6139 – South Africa
[4] KwaZulu-Natal Museum, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa

The Diversity of Pollinating Diptera in South African biodiversity hotspots (DIPoDIP) project studies the biodiversity of selected true fly families, including hoverflies or Syrphidae, in South African Biodiversity Hotspots. The project improves the taxonomy and identification of the South African hoverfly species and provides basic data on their distribution and pollination ecology in order to study plant-pollinator co-evolution. Amongst other things, this is achieved through training of PhD, MSc and BSc students and joint fieldwork and research. The research delivers data for Red List assessments and improved conservation strategies for these Biodiversity Hotspots. A work-shop with local partners, conservationists, Red List assessors and stakeholders will be organized in 2023 to translate the results for policy making . Results will be presented to the larger public to raise awareness of the importance of hoverflies in pollination, food security and nature conservation.

The DIPoDIP project is financed through the Belgian Directorate-General for Development Cooperation (DGD).

Keywords: South AFrica, Biodiversity hotspots, education, public awareness

*Corresponding author: kurt.jordaens@africamuseum.be

Syritta diversity in the Afrotropical Region

Kurt Jordaens * [1], Georg Goergen [2], John Midgley [3,4], Terence Bellingan [3,5], Bonolo Mosime [4,6], Marc De Meyer [1], Jeroen van Steenis [7]

[1] Royal Museum for Central Africa, Invertebrates Section, Leuvensesteenweg 13, 3080 Tervuren – Belgium
[2] International Institute of Tropical Agriculture (IITA), Biodiversity Centre, 08 BP 0932 Tri Postal, Cotonou – Benin
[3] Department of Zoology & Entomology, Rhodes University, Makhanda, 6139 – South Africa
[4] KwaZulu-Natal Museum, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa
[5] Department of Entomology & Arachnology, Albany Museum, Makhanda, 6139 – South Africa
[6] University of KwaZulu-Natal, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa
[7] Naturalis Biodiversity Center [Leiden] – The Netherlands

The revision of the hoverfly genus *Syritta* Le Peletier & Serville, 1828 by Lyneborg & Barkemeyer (2005) comprises approximately 60 species worldwide, with 40 of these recorded from the Afrotropical Region. Over the last decade, we have colleced and studied > 2,000 *Syritta* specimens from almost 20 Afrotropical countries and have used morphology and DNA barcoding to identify the species, and to link males to females. This has resulted in at least six new species and the discovery of the missing sex for eight species where only one of the sexes was known. Adding museum collections to the newly collected material allowed us to study the species distributions, diversity, biogeography and predict future distributions using modelling techniques. Moreover, an updated identification key will be provided including high-resulution stacking photographs for both males and females.

Keywords: South Africa, Biodiversity hotspots, biogeography, species distribution modelling

*Speaker

Poster N° 10

Hoverflies (Diptera: Syrphidae) of the Parco delle Gole della Breggia - Biodiversity and habitat assessment using the Syrph the Net method

Bärbel Koch * [1], Lucia Pollini Paltrinieri [1], Isabella Forini-Giacalone [2]

[1] Museo cantonale di storia naturale, Lugano – Switzerland
[2] Independant Researcher, Monte Carasso – Switzerland

Since 2018, the "Working Group Sirfidi Ticino" has promoted a series of research on Syrphidae (Diptera) in the southern region of the Swiss Alps (Canton Ticino). Applying the Syrph the Net (StN) methodology, the environments in the geological park Parco delle Gole della Breggia located in the extreme south of Switzerland were assessed by means of one of these researches. Therefore, hoverflies were sampled with 6 Malaise traps at three survey sites between April 2018 and May 2019. During this period, we found 1229 specimens belonging to 97 hoverfly species, which corresponds to approximately one third of the current hoverflies known for the southern region of the Swiss Alps. StN analyses showed a functional integrity of 51%, corresponding to a good ratio between the observed and the expected species. The environments with the most complete hoverfly community were the *Castanea* forest (76%) and the Eastern thermophilus Quercus forest (68%), while the worst results were obtained for the wetland environments, i.e. the Fen carr macrohabitat (55%) and the Reed/tall sedge beds macrohabitat (50%). The richness of hoverfly species in the Parco delle Gole della Breggia is probably due to the complex mosaic of different environments and the highly diversified structures (rock walls, different types of watercourses, ruderal spaces and meadows) that create a high variety of ecological niches. Although of lower quality than forests macrohabitats, a result probably also due to the very limited surface area of these environments, the wetland environments are very valuable for the area as they support several rare and threatened species. The proportion of threatened or declining species found during this study is relatively high, highlighting the important role of Parco delle Gole della Breggia in the conservation of hoverflies in the southern region of the Swiss Alps.

Keywords: habitat evaluation, monitoring, southern Alps, species diversity, Switzerland, Syrph the Net

*Corresponding author: baerbel.koch@ti.ch

Poster N° 11

New additions to species genetic characterization of *Merodon clavipes* and *Merodon pruni* (Diptera: Syrphidae) species groups

Nataša Kočiš Tubić * [1], Mihajla Djan [1], Ante Vujić [1], Snežana Radenković [1]

[1] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Trg Dositeja Obradovića 2, 21000 Novi Sad, Serbia – Serbia

The *Merodon clavipes* and *Merodon pruni* species groups are two out of 10 established groups within the *M. avidus-nigritarsis* lineage. The both groups were primarily defined by Hurkmans (1988) and then revised by Likov et al. (2020) and Vujić et al. (2021). Likov et al. (2020) presented *M. clavipes* group in a much narrower sense compared to Hurkmans (1988), mentioning only two representatives: *M. clavipes* and *M. velox.* Vujić et al. (2021) added few diagnostic features and appended *M. quadrinotatus* and *M. vandergooti* Hurkmans, 1993 species to previous two species. Within *M. pruni* group, two species were mentioned in Likov et al. (2020): *M. pallidus* Macquart, 1842 and *M. pruni* Rossi, 1790, while the most recently, Vujić et al. (2021) listed four species belonging to this species group: *M. cupreus* Hurkmans, 1993, *M. pallidus*, *M. pruni* and one undescribed taxon from Israel. Here we analysed molecular data based on the sequences of the mitochondrial *COI* gene (cytochrome c oxidase subunit I) in addition to traditional morphological character with the aim to describe the hidden taxonomic complexity of the *M. clavipes* and *M. pruni* taxa. In the employed Maximum Parsimony approach, together with analysed species of the groups, we involved the representatives of previously described *Merodon* lineages by Vujić et al. (2021), as well as species from the groups of the *avidus-nigritarsis* lineage. The analysis based on 72 concatenated nucleotide sequences (612 bp of 5 ' fragment of *COI* gene and 661 bp of 3 ' fragment of the gene) revealed all five lineages as clades (Fig. 1). Within the *avidus-nigritarsis* lineage, the both analysed species groups resolved as monophyletic with 100 bootstrap support. Taxon *M.* aff. *clavipes* from Spain clearly separated (80 bootstrap) from the other analysed species of the groups (*M. clavipes* and *M. velox*), indicated existence of additional new species of the group. Within the *M. pruni* group, previously known variety *Merodon pruni* var. *obscurus* Gil Collado, 1929 proved to be valid species, revealing as separated clade with 99 bootstrap support on obtained MP tree.

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Keywords: molecular taxonomy, mtCOI gene, Maximum Parsimony analysis, hoverflies

*Corresponding author: natasa.kocis@dbe.uns.ac.rs

Dynamics around syrphids in the French Natural Reserves

Dominique Langlois *† [1]

[1] Conservatoire d'espaces naturels de Franche-Comté – France

The first studies on Syrphids in French nature reserves began in 2005. They took place in Haute-Savoie, thanks to Jean-Pierre and Véronique Sarthou, Emmanuel Castella and Martin Speight. The StN (Syrph-the-Net) method were deployed there and results were appreciated by French Nature reserves and Wildlife trusts. They have organized and initiated a training course to popularize StN in France. A three-year training cycle is held since 2009, beginning with an introductory course teaching how to set up Malaise traps and deploy the StN methodology on a site. In year 2, another week is an improvement to the identification of syrphids and year 3 course is for processing the data. Since 2009, five training courses have been organized, involving 65 people and giving rise to around 100 StN studies, in different types of habitats (woodlands, peatlands, wetlands, grasslands, urban green areas...).
The StN method consists of a comparison between an observed syrphids community (with Malaise traps and complementary net catching) and a predicted community (developed from a life habits' database). This comparison provides information on which parts of the macrohabitat are performing well and which are not. A methodological guide was published in 2020 (Vanappelghem *et al.*).
This national syrphids dynamic has been reflected in at least 3 regional programmes: "Jura's peatlands LIFE" (2015-2021) has used syrphids as indicator of biodiversity maintenance potential of habitats to restore, the "Sapoll" (Save the pollinators) cross-border program (France-Wallonie-Vlaanderen, 2019-2029) has made it possible to initiate a broader knowledge dynamic on syrphids in the Haut de France (regional catalogue, training courses...) and Bourgogne-Franche-Comté syrphids' catalogue, published in 2022, is going to propose a first syrphids regional red list.

Keywords: Syrph-the-Net, France, Nature reserves, Conservation

*Speaker
†Corresponding author: dominique.langlois@espaces-naturels.fr

Leucorum vernum, an alternative larval host plant for *Merodon analis* in East part of France

Dominique Langlois *† [1]

[1] Dominique Langlois – independent entomologist – France

Information on the distribution, recognition and biology of *Merodon analis* Meigen, 1822 in France is reviewed, in the light of 2020 advances in knowledge of the *Merodon constans* group in Europe. *Merodon analis* is known to develop as a larva in bulbs of the indigenous snowdrop, *Gallanthus nivalis* L., 1753. An investigation carried out in Doubs (25), during the first quarter of 2021, demonstrates that *Leucojum vernum* L., 1753 is an alternative larval host plant, explaining the presence of *Merodon analis* in eastern parts of France where *Gallanthus nivalis* is virtually absent. Examination of the terminalia of males reared during course of this study repeatedly raised questions concerning the presence of *Merodon constans* (Rossi, 1794) in France, a species reported in Europe from Greece to Italy but not west of the Alps, and currently indistinguishable genetically from *M. analis*.

Keywords: *Merodon analis, Merodon constans*, France, *Leucorum vernum*

*Speaker
†Corresponding author: dl.entomo@gmx.com

Poster N° 12

New records on the distribution and diversity of *Merodon* Meigen, 1803 (Diptera: Syrphidae) in Middle East and Central Asia

Laura Likov * , Snežana Radenković [1], Ante Vujić [1]

[1] University of Novi Sad – Serbia

Recent research by Vujić et al. (2021a) stated 234 species in total from genus *Merodon* (Diptera: Syrphidae), from which 17 species are still undescribed so far from the region of the Middle East and Central Asia. This region was recognized as one of the centers of diversity and endemism of the genus *Merodon* (Kaloveloni et al., 2015; Vujić et al., 2019; Likov et al., 2020; Vujić et al., 2021). The 17 species mentioned above are as follows: one species from *spinitarsis* species group (distributed in Israel and Turkey), one species from *murorum* species group (distributed in Iran), two species from *aberrans* species group (distributed in Iran, Israel and Lebanon), one species from *clavipes* species group (distributed in Iran), two species from *avidus* species group (distributed in Iran and Azerbaijan), one species from *pruni* species group (distributed in Israel and Palestina), five species from *tarsatus* species group (distributed in Iran, Turkmenistan, Israel, Afghanistan and Pakistan), two species from *ottomanus* species group (distributed in Iran and Turkey), one from *caudatus* species group (distributed in Israel), and one unplaced species (distributed in Pakistan). This contribution contains basic distributional data for these species and discussion about diversity of *Merodon* species in these regions.

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Keywords: *Merodon*, new species, distribution

*Corresponding author: laura.likov@dbe.uns.ac.rs

Predatory Syrphinae of phytophagous insects in Brazil: taxonomy, interaction network and agricultural host plants

André Fontinelle Magalhães *† [1], Márcia Couri [1], Mírian Morales [1]

[1] Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro – Brazil

Almost 10% of the worldwide species of Syrphidae are recorded in Brazil (*i.e.* 591 species in 79 genera). Larvae have different feeding habits and predation gives an outstanding look to the members of the Syrphinae subfamily, which have a fundamental role in biological control. They represent about 35% of all species in the family. There are 231 species within 28 genera of Syrphinae recorded in Brazil according to Morales & Marinoni (2021). Most larvae feed on soft-bodied insects and are easily found associated with infestations of Hemiptera, Lepidoptera and Thysanoptera. Syrphinae have great potential as biological control agents and their adults mostly visit flowers for pollen and nectar search, being potential pollinators. Immatures are the developmental stage most commonly found in infestations, and the larvae must be reared to obtain adults to identify. The lack of identification keys to larvae difficult researches – *e.g.,* ecology and biology. The aim of this investigation is to update the list of Brazilian species presented by Rojo *et al* (2003), produce images of the immature stages and an identification key, besides information on interaction networks. We are collecting on organic and traditional crops (with low to intense pesticides use), infested with phytophagous insects in Minas Gerais, Brazil, seeking new interactions. The captured larvae are individually placed in Petri dishes and fed with the insect prey they were feeding in the host plant to obtain the adult. Rojo *et al* (2003) listed 80 occurrences of interactions between syrphids and their preys in Brazil. Until now, we have sampled individuals of one specie belonging to *Dioprosopa* Hull, 1949, one to *Eosalpingogaster* Hull, 1948, two to *Allograpta* Osten-Sacken, 1875, four *Ocyptamus* Macquart, 1834, and two *Toxomerus* Macquart, 1855 in *Solanum paniculatum* L., *Citrus* spp., *Nicotiana tabacum* L., *Vigna unguiculata* (L.) Walp., *Brassica oleracea* L., *Punica granatum* L.

Keywords: biological control, morphology, agriculture

*Speaker
†Corresponding author: fontinelleandre@gmail.com

Poster N° 13

Fauna of hoverflies (Diptera: Syrphidae) of less explored Mediterranean mountains in Montenegro

Suzana Malidžan * [1], Milica Ranković [2], Snežana Radenković [2], Ante Vujić [2]

[1] Natural History Museum of Montenegro, Podgorica – Montenegro
[2] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Novi Sad – Serbia

The fauna of hoverflies of Montenegro is rich with currently 386 registered species (Malidžan et al, in prep.), and a significant number of rare and endemic species. However, many parts of the country are still poorly explored, including some protected areas. There are 76 protected areas in Montenegro, which occupies 11.42% of the territory.
National Park Durmitor is the only well-studied protected area, while data for other ones are scarce and sporadic. This paper will provide an overview of the hoverflies fauna of the Mediterranean mountains Orjen and Lovćen, which have been the subject of research in the last few years. Orjen is a mountain in the southwest of Montenegro, located in the hinterland of the Bay of Kotor, and is under the direct influence of the Mediterranean climate. Researched sites on this mountain belong to the Nature Park Orjen. Lovćen mt rises from the borders of the Adriatic cost in the southwest of the country, and the influence of the Mediterranean is particularly strong on their southern parts. The central part of the Lovćen mountain belongs to the National Park Lovćen, as well as the researched localities. A total of 130 species, from 44 genera, have been registered in the investigated areas so far. Moreover, 15 species are recorded for the first time in Montenegro. Comparison of the similarity and differences of the species diversity between these two protected areas, as well as an overview of rare, endangered (of the European Red List), and endemic species are provided.

Acknowledgments
This study was financially supported by the Natural History Museum of Montenegro

Keywords: syrphids, fauna, Montenegro, Mediterranean mountains, protected areas, new records

*Corresponding author: suzana.malidzan@gmail.com

Poster N° 14

Proposal of a new monitoring method for *Mallota fuciformis* (Diptera: Syrphidae), a saproxylic pollinator

Umberto Maritano [1]

[1] Independent researcher – Italy

Hoverflies play a key role in pollinating and other forest ecosystem services. They can be used as bioindicators of many different habitats. The presence of species with high environmental requirements, especially in forest ecosystems, can be a fundamental tool for developing the right management plan for biodiversity conservation also in an ecological connectivity perspective. *Mallota fuciformis* Fabricius, 1794 is an elusive saproxylic species listed as threatened in many European countries and internationally recognised as a species of conservation interest. In this paper, we provide for the first time a targeted, fast and effective standardised field protocol for the detection of *Mallota fuciformis* in oak-hornbeam stands and alluvial forests with oaks along lowland streams. Given the short period of flight of the species, 88 sites were considered enough to testify this standardised methodology. The study was carried out in the Piedmont region (Northwestern Italy) between 2019 and 2022. Overall, 48 sites have proved to be positive for the presence of the species. The average detection time was very short in positive sites, suggesting the effectiveness of this approach in fast surveys. The proposed protocol can be extended to other geographical areas. The possibility to apply the proposed methodology for extensive ecological connectivity studies is discussed.

Systematics and evolution of Syrphinae based on exon-capture sequencing

Ximo Mengual * [1], Christoph Mayer [1], Trevor O. Burt [1], Kevin M. Moran [2,3], Lars Dietz [1], Gaby Nottebrock [1], Thomas Pauli [4], Andrew D. Young [5], Marie V. Brasseur [1], Sandra Kukowka [1], Scott Kelso [2], Claudia Etzbauer [1], Sander Bot [6], Martin Hauser [7], Kurt Jordaens [8], Gil F. G. Miranda [2], Gunilla Ståhls [9], Wouter van Steenis [10], Ralph. S. Peters [1], Jeffrey H. Skevington [2]

[1] Zoologisches Forschungsmuseum Alexander Koenig, Leibniz-Institut zur Analyse des Biodiversitätswandels, Adenauerallee 127, 53113 Bonn – Germany
[2] Agriculture and Agri-Food Canada, Canadian National Collection of Insects, Arachnids and Nematodes, K.W. Neatby Building, 960 Carling Avenue, Ottawa, Ontario, K1A 0C6 – Canada
[3] Carleton University, Department of Biology, 1125 Colonel By Drive, Ottawa, Ontario, K1S 5B6 – Canada
[4] Institute of Medical Bioinformatics and Systems Medicine, Medical Center-University of Freiburg, Faculty of Medicine, University of Freiburg, Freiburg – Germany
[5] University of Guelph, School of Environmental Sciences, Guelph, Ontario – Canada
[6] Kerklaan 30E, NL-9751 NN, Haren – The Netherlands
[7] California Department of Food and Agriculture, 3294 Meadowview Road, Sacramento, California – United States
[8] Royal Museum for Central Africa, Joint Experimental Molecular Unit, Leuvensesteenweg 13, Tervuren – Belgium
[9] University of Helsinki, Finnish Museum of Natural History Luomus, Pohjoinen Rautatiekatu 13, 00100, Helsinki – Finland
[10] Vrouwenmantel 18, NL-3621 TR, Breukelen – The Netherlands

In the present study, we used high-throughput sequencing to capture and enrich exonic regions. With the help of the BaitFisher software, we developed a new bait kit (SYRPHIDAE1.0) to target 1945 CDS regions belonging to 1312 orthologous genes. This new bait kit was successfully used to exon-capture the targeted loci in 121 flower fly species across the different syrphid subfamilies. We analyzed different amino acid and nucleotide data sets with the Maximum Likelihood and the Multispecies Coalescent approaches. Our analyses yielded highly supported similar topologies, although the degree of the SRH (global Stationarity, Reversibility and Homogeneity) conditions varied greatly between amino acid and nucleotide data sets. The sisterhood of subfamilies Pipizinae and Syrphinae is recovered in all our analyses, confirming a common origin of taxa feeding on soft-bodied arthropods. Based on our results, we redefine the tribe Syrphini **stat.rev.** and infer the origin of the Syrphidae using BEAST.

Keywords: target DNA enrichment, Syrphidae, Syrphinae, flower flies, hoverflies, hoverflies, tribal classification

*Speaker

A global perspective of hoverfly migration

Myles Menz *† [1]

[1] James Cook University – Townsville, Australia

Hoverflies have been shown to be common migrants on a number of continents, with billions of individuals migrating, annually. Hoverfly migration represents an immense movement of biomass and a significant flux in the availability of ecosystem services in an area. Hoverflies are key pollinators, predators, and decomposers in many habitats, making the study of their migration critical for understanding and conserving their roles in the ecosystem. However, our knowledge of hoverfly migration is still fairly incomplete, with many exciting discoveries still being made. For example, migratory events in some countries have only been reported relatively recently. Furthermore, there is still much to be learned about the mechanisms driving hoverfly migration, the routes they take, how they behave and navigate en route, and the role of migrants in the ecosystem.

Concerningly, some long-term studies of hoverfly migration in Europe have indicated declines in the number of migrants over time, echoing the declines observed in other insect groups, and indicating potential threats to hoverfly populations.

I will present a global overview of hoverfly migration, incorporating knowledge on the geographic occurrence, species involved, and mechanisms driving migratory movements. I will also discuss key gaps in knowledge and highlight areas that may be fruitful for further research into this fascinating phenomenon.

Keywords: insect migration, deline, ecosystem services.

*Speaker
†Corresponding author: myles.menz@jcu.edu.au

Poster N° 15

Potential effect of climate change on the distribution of Afrotropical *Syritta* species (Diptera: Syrphidae)

John Midgley * [1,2], Kurt Jordaens [3], Bonolo Mosime [2,4]

[1] Department of Zoology & Entomology, Rhodes University, Makhanda, 6139 – South Africa
[2] KwaZulu-Natal Museum, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa
[3] Royal Museum for Central Africa, Invertebrates Section, Leuvensesteenweg 13, 3080 Tervuren – Belgium
[4] University of KwaZulu-Natal, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa

Climate change and land-use change threatens global biodiversity. Loss of pollinators in particular could have major ecological and economic implications. Species distribution models are one tool used to assess potential impacts of climate change on species. There is little documentation on the distribution, vulnerability and conservation status of Afrotropical *Syritta*. In this study, 2 *Syritta* species' known occurrence data were used as predictors for the analysis of habitat preferences, potential shifts in species distribution and shifts in bioclimatic range within South Africa. Ensemble modelling approach based on 3 model algorithms (maximum entropy, random forest and generalized linear models) were used with 3 assessment metrics (TTS, AUC, COR) to identify the important predictor variables. The analysis shows a wide and uneven distribution across the delineated geographic regions, with rainfall and temperature expected to influence the probability of geographic distribution of *Syritta* in South Africa. This study is important in developing long-term regional monitoring *Syritta* biodiversity hotspots and potential conservation strategies.

Keywords: Ecological niches, Ensemble modelling Hoverflies, Species distribution modeling

*Corresponding author: jmidgley@nmsa.org.za

Poster N° 16

Biological observations of *Meromacroides meromacriformis* (Bezzi, 1915) (Diptera: Syrphidae) in South Africa

John Midgley [1,2], Terence Bellingan [3,4], Kurt Jordaens [5], Georg Goergen [6]

[1] KwaZulu-Natal Museum – South Africa
[2] Rhodes University, Grahamstown – South Africa
[3] Department of Zoology & Entomology, Rhodes University, Makhanda, 6139 – South Africa
[4] Department of Entomology & Arachnology, Albany Museum, Makhanda, 6139 – South Africa
[5] Royal Museum for Central Africa, Joint Experimental Molecular Unit, Leuvensesteenweg 13, Tervuren – Belgium
[6] International Institute of Tropical Agriculture (IITA), Biodiversity Centre, 08 BP 0932 Tri Postal, Cotonou – Benin

Meromacroides meromacriformis (Bezzi, 1915) is an enigmatic hoverfly, first collected in South Africa in the 1850s, but not again until 2020. A further collection in 2022 was also made in the country. While widespread in Africa, the species is rarely encountered and information about its biology is scarce. The recent collections in South Africa were associated with colonies of *Schedorhinotermes lamanianus* (Isoptera: Rhinotermitidae) found in rot-holes within the trunk of a standing living trees and in 2022 larvae were collected from a frass midden. The link between termites and *Meromacroides meromacriformis* requires further investigation, but this habitat specialization may explain why the species is encountered infrequently. Efforts are underway to enhance conservation of both sites through education panels in collaboration with local wildlife authorities.

Keywords: termitophile, Africa, flower fly, pollinators

Poster N° 17

Taxonomic notes on *Spheginobaccha pamela* Thompson & Hauser, 2015

John Midgley [1,2], Terence Bellingan [1,3], Kurt Jordaens [4]

[1] Department of Zoology & Entomology, Rhodes University, Makhanda, 6139 – South Africa
[2] KwaZulu-Natal Museum, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa
[3] Department of Entomology & Arachnology, Albany Museum, Makhanda, 6139 – South Africa
[4] Royal Museum for Central Africa, Invertebrates Section, Leuvensesteenweg 13, 3080 Tervuren – Belgium

Spheginobaccha de Meijere 1908 is a rare genus of hoverflies, restricted to the Afrotropical and Oriental regions. Only eight species are known from the Afrotropics, of which only three are known from both sexes. The recent discovery of a female *Spheginobaccha pamela* Thompson & Hauser, 2015 specimen as well as recent collections of the species in South Africa brings this number to four. We present photographs and taxonomic notes on the female of *Spheginobaccha pamela* for the first time.

Keywords: Africa, Afrotropical Region, DNA barcoding, flower fly, taxonomy

A preliminary checklist of Syrphidae from South Africa

John Midgley * [1,2], Terence Bellingan [1,3], Kurt Jordaens [4]

[1] Department of Zoology & Entomology, Rhodes University, Makhanda, 6139 – South Africa
[2] KwaZulu-Natal Museum, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa
[3] Department of Entomology & Arachnology, Albany Museum, Makhanda, 6139 – South Africa
[4] Royal Museum for Central Africa, Invertebrates Section, Leuvensesteenweg 13, 3080 Tervuren – Belgium

Species checklists provide valuable information for conservation planning, as well as the opportunity to predict ecological service potential from certain groups. A complete checklist of the Syrphidae of South Africa has not been published, though Barraclough (2010) provided a list of 154 species compiled from published literature. Including museum records increased this to 234 species by 2019. Further fieldwork in 2020, 2021 and 2022 has increased the number to over 260. Given the number of new records produced in this two-year period, it is likely that further sampling will result in this list increasing further.

Keywords: Species distribution, flower flies

*Speaker

Poster N° 18

Taxonomic notes on the genus *Amphoterus* Bezzi 1915

John Midgley [1,2], Terence Bellingan [1,3], Kurt Jordaens [4]

[1] Department of Zoology & Entomology, Rhodes University, Makhanda, 6139 – South Africa
[2] KwaZulu-Natal Museum, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa
[3] Department of Entomology & Arachnology, Albany Museum, Makhanda, 6139 – South Africa
[4] Royal Museum for Central Africa, Invertebrates Section, Leuvensesteenweg 13, 3080 Tervuren – Belgium

The genus *Amphoterus* Bezzi 1915 is a rare group of hoverflies restricted to the Afrotropical region. Two species are recognised, *Amphoterus cribratus* Bezzi 1915, known from only one male and one female, and *Amphoterus braunsi* van Doesburg 1956, described from a single male. While not often collected, a large series of *A. braunsi* has been accumulated over time at the KwaZulu-Natal Museum. Apart from the usual sexual dimorphism, patterns of pilosity on the face can be used to differentiate males from females in the genus. Photographs, DNA barcodes and notes on useful taxonomic features will be presented.

Keywords: DNA barcoding, flower flies, Afrotropical region

Hoverfly (Diptera: Syrphidae) research in the past 25 years - a bibliometric analysis

Marija Miličić *† [1], Marina Janković Milosavljević [2], Snežana Popov [2], Andrijana Andrić [1], Jelena Ačanski [1], Ante Vujić [2]

[1] BioSense Institute – Research Institute for Information Technologies in Biosystems, University of Novi Sad, Novi Sad – Serbia
[2] Department of Biology and Ecology, Faculty of Sciences, University of Novi Sad, Novi Sad – Serbia

Hoverflies are known as pollinators, bioindicators, and some species are used as biological control agents. Due to these invaluable functions in the ecosystem, hoverfly research has seen a recent rise in the previous years.
Bibliometric analysis represents a type of statistical analysis used to summarize academic literature in a quantitative way. This analysis encompasses scientific journals, authors, countries and institutions and enables grasping the basic information and development of a certain research topic in literature quickly.

In this study, we aim to give an overview of hoverfly research in the past 25 years, by inspecting publication characteristics of papers, analyzing source and author impact and assessing main research themes. For this purpose, Web of Science, one of the leading databases of research publications and citations in academia, was used for the acquisition of the hoverfly-related research, in the period 1996-2021. Analyses were conducted using R package bibliometrix and R Shiny app biblioshiny.

In total, 1843 original research articles related to hoverflies were published in the past 25 years in scientific journals, authored by 4594 persons. Top author based on the number of publications was Ante Vujić, while most relevant journal based on the same criterion was Zootaxa. USA had highest country production, while University of Novi Sad, Serbia was the most relevant affiliation. Five most frequently used keywords in articles were Syrphidae, hoverflies, Diptera: pollination and biological control.

Acknowledgements
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Keywords: bioindicators, biological control agents, insects, literature, pollinators, research trends, quantitative analysis

*Speaker
†Corresponding author: marija.milicic@biosense.rs

Diversity of Syrphidae in the Tropical Andes

Augusto Montoya Giraldo *† [1]

[1] Universidad de Antioquia – Colombia

The Paramos or tropical alpine ecosystems are isolated mountain systems located above the tree line (> *ca.* 3,000 m of altitude) of Colombia, Venezuela, Ecuador, Peru, and Bolivia. The Paramos form an archipelago of continental biogeographic islands on mountain tops, surrounded by high Andean cloud forests and disturbed areas (open and homogeneous areas, modified for livestock activities and agricultural crops). The region has been an obligatory route for many organisms and is characterized by an intricate vegetation structure, heterogeneous topography, and complex geographical history triggered by environmental change and global cooling, constituting the "global epicenter of biodiversity". In the past, the Paramos were presumably widespread and connected during the glacial periods while highly fragmented during the extreme interglacial periods. These intermittent connectivity cycles (climatic variations due to glacial/interglacial periods) as well as the altitudinal isolation (topographic barrier due to orogeny), favored one of the most recent and fastest adaptative radiations by allopatric speciation, triggered by island-like ecological opportunities in the mountain tops. The availability of new habitats and harsh environmental conditions (high radiation, extreme winds, and low temperatures) favor the colonization, establishment, adaptation, and diversification of unique and specialized fauna. In consequence, Paramos are currently recognized globally for their high endemism and unmatched species richness concentrated in a relatively small isolated area but are among the ecosystems most threatened by global warming and increasing anthropogenic pressures (e.g. large-scale metal mining, fracking, indiscriminate and constant application of pesticides, deforestation for timber extraction, as well as rampant arson of land around the forest to clear land for agriculture and the expansion of extensive cattle ranching), that have resulted in the ecosystem fragmentation into small mosaics of isolated highland islands and forest patches in which only a few remnants of primary vegetation remain, projecting a high extinction risk. These factors generate singular patterns of continental insularity, whose impacts on biodiversity remain to be examined, making biodiversity research a priority to help understand this fragile ecosystem. Given that more than 43% of the Neotropical Syrphids diversity is concentrated in the Tropical Andes, the endemic and restricted groups should be considered as a flagship for conservation planning and management. Therefore, the origin, diversification, composition, and diversity of emblematic Tropical Andes Syrphids groups will be discussed in the context of conservation and climate change. The challenges and future direction of research on the flower fly fauna in the Tropical Andes will also be enumerated and debated.

Acknowledgments: Thanks to Entomology Group, University of Antioquia (GEUA). Funds were provided by COLCIENCIAS (Convocatorias 745-2016, 647-2014, 1030-2021). Thanks are also due to the IRD and the symposium organizing Committee which made the participation to the Syrphidae symposium feasible.

Keywords: Highland ecosystems, Endemism fauna, Flagship groups, origin, diversification, composition, diversity.

*Speaker

†Corresponding author: aleon.montoya@udea.edu.co

Poster N° 20

The flower flies of subgenus *Platycheirus* (*Tuberculanostoma*) Fluke as flagship entities for the conservation of Páramo ecosystems in Tropical Andes

Augusto Montoya Giraldo * [1], F. Christian Thompson [deceased] [2]

[1] Universidad de Antioquia – Colombia
[2] Department of Entomology, National Museum of Natural History, Smithsonian Institution – U.S.A.

Above 3000 m a.s.l., 'Páramo' ecosystems cover more than 35,000 km2 of Tropical Andes. The Paramos or tropical alpine ecosystems are isolated mountain systems, located above the tree line and forming intracontinental "sky islands" surrounded by forests and disturbed areas. In these ecosystems, animals and plants have faced recent and rapid radiation, as a result of altitudinal isolation and geographical barriers (Andean uplift), facilitated by allopatric speciation. The availability of unique microhabitats and harsh environmental conditions have favored the establishment and adaptation of unique fauna. Despite their importance, Paramos are among the ecosystems most threatened by global warming and anthropogenic pressure, with a high number of projected extinctions. One emblematic group exclusively inhabiting Páramo is the subgenus *Platycheirus* (*Tuberculanostoma*) Fluke, including four recognized species as well as seven in process of description, distributed from their northernmost point at 8.80°N in Venezuela to -18.23°S on the Bolivian southern. The restricted distribution, local abundance and the fact that inhabit threatened ecosystems in the hotspot (Protected and Conserved Areas) are compelling reasons to consider them as flagship entities for the conservation of Páramo. In this sense, it is necessary to assess the conservation status following the criteria of the International Union for Conservation of Nature (IUCN) as a first step to developing a conservation strategy for future planning and management projects in Páramo ecosystems.

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Keywords: Highland ecosystems, Flagship species, assessment of conservation status, Endemism, unique fauna.

*Corresponding author: aleon.montoya@udea.edu.co

Poster N° 19

Origin, diversity and endemism of the Neotropical Syrphidae: implication for conservation of rare and threatened genera

Augusto Montoya Giraldo * [1], Gil Miranda [2]

[1] Universidad de Antioquia – Colombia
[2] Instituto Nacional de Pesquisas da Amazônia – Brazil

The Neotropical region is well known for its rich biodiversity and constant conservation efforts. The region is characterized by a complex vegetation structure, heterogeneous topography, and singular geographical history, with recognition of 53 biogeographical provinces and seven hotspots. The region has been an obligatory route for many organisms, providing ecological opportunities for the establishment, adaptation, and permanence of a specialized fauna, whose origin and diversification constitute a hot research topic, but with a large gap in conservation status of its fauna.
The greatest diversity of Syrphidae occurs in the Neotropical region, with 1560 species (76.8% endemic), but with a large number of species still waiting to be discovered and/or described. Despite its exuberant richness, the region is facing anthropogenic pressures, putting at risk the survival of its species and the maintenance of the ecosystem services provided. Since the Neotropical region is considered one of the most threatened on Earth, biodiversity research is a priority to help design conservation actions.

In order to produce a comprehensive red-list, and identify target species for conservation, we developed a database with the currently valid Neotropical species of Syrphidae, including 129 genera, and 1535 species. Our analysis suggests that in terms of origin and diversity, the Neotropical fauna is composed of 4 distinctive elements: 83 Neotropical endemic genera (1182 spp, 76.8%), 29 Palearctic genera (205 spp, 13.5%), 12 Nearctic genera (146 spp, 9.6%), and a single Oriental genus (1 sp, 0.1%).

We identify cryptic genera whose species composition, rarity, and distinctive biogeographic patterns will be a starting point to assess the threats status in the Neotropical region.

Acknowledgments: Thanks to Entomology Group, University of Antioquia (GEUA). Funds were provided by COLCIENCIAS (Convocatorias 745–2016, 647-2014, 1030-2021). Thanks are also due to the IRD and the symposium organizing Committee which made participation to the Syrphidae symposium feasible.

Keywords: Highland ecosystems, Flagship species, Amazonian region, Tropical Andes, Endemism

*Corresponding author: aleon.montoya@udea.edu.co

Structure and diversity of flower flies (Diptera: Syrphidae) in northwestern Colombian Paramos: towards the identification of bioindicator species in the Tropical Andes

Augusto Montoya Giraldo *† [1], Juan Parra [1], Marta Wolff [1]

[1] Grupo de Entomología, Universidad de Antioquia (GEUA), Medellín – Colombia

The Paramos are isolated mountain systems, located above the tree line and forming intra-continental "sky islands" surrounded by forests and disturbed areas. Despite their importance as water reservoirs and endemism concentration, are threatened by global warming and anthropic activities. We characterized the spatial distribution of Syrphidae diversity in two Paramo complexes in Colombia to identify potential bioindicators for montane habitats. We hypothesized that bioindicator species must be abundant and exhibit affinity for a particular habitat when replacement between and/or within habitats tended to be strong. Twelve bimonthly samples of ten days were done comprising 18 sampling stations distributed among three habitat types: Paramo, forest, and grassland. Flies were collected using ground and canopy Malaise traps, colored pan-traps, and sweeping. We estimated alpha and beta diversity components within and between habitats. We identified potential bioindicator species based on exclusivity and fidelity criteria. We collected 2783 specimens in 41 genera and 148 species. Paramo had the highest richness and collections (110 species, n= 1878), followed by forest (88 species, n= 357), and grassland (59 species, n= 571). Species replacement was dominant component of incidence-based betadiversity. Similar contribution of nestedness and turnover between paramo and grassland reinforces the hypothesis that grassland communities may represent disturbed paramo. We propose eleven genera and fourteen species as bioindicators of paramo, one genus for forest, and one genus and two species for grassland, potentially useful to evaluate and implement conservation programs in Andean ecosystems.

Implications for conservation

Bioindicator species facilitate monitoring ecosystems, a necessary procedure to forecast and mitigate variations due to climate change and anthropogenic advances. Paramos harbor great richness in relatively small areas and are under constant threat due to agricultural and mining practices. The conservation will guarantee not only persistence of ecological services provided by hoverflies but also protection of a unique component of world's biodiversity.

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Keywords: Beta diversity, Species turnover, Habitat marker species, Functional trophic groups, Conservation corridors, Tropical Andes

*Speaker

†Corresponding author: aleon.montoya@udea.edu.co

Functional diversity of neotropical mangrove pollinators and their responses to land use change

Paula Montoya-Pfeiffer* [1], Carlos Sarmiento Monroy [2], Augusto Montoya Giraldo † [3], Eliana Buenaventura [4], Jenny Rodríguez-Rodríguez [1]

[1] Programa Calidad Ambiental Marina, Instituto de Investigaciones Marinas y Costeras "José Benito Vives de Andreis" INVEMAR – Colombia
[2] Instituto de Ciencias Naturales, Universidad Nacional de Colombia – Colombia
[3] Grupo de Entomología, Universidad de Antioquia (GEUA), Medellín – Colombia
[4] Museum für Naturkund, Berlin – Germany

Pollinators are declining as a result of anthropization. Despite the great importance that mangrove ecosystems have for human welfare, little is known about what is happening with mangrove pollinators and it is evident that its genetic diversity is been lost from degradation. This work evaluates for the first time the effects of mangrove patch areas and the surrounding landscape on the pollinator's composition of the four dominant mangrove species in Colombia's Caribbean coast. A total of 819 pollinator individuals, distributed in 30 families and 162 morphospecies, were collected in the study area. Sarcophagidae was diverse (28 spp.), followed by Crabronidae (15), Vespidae (15), Syrphidae (13), Halictidae (11), and Apidae (10). Vespidae was abundant (n=215), followed by Apidae (n=174), Crabronidae (n=103), Syrphidae (n=73), Sarcophagidae (n=66), Oedemeridae (n=46) and Halictidae (n=29). *Polybia occidentalis venezuelana* and *Apis mellifera* were abundant with 121 and 101 individuals, respectively; other species included less than 39 individuals. Pollinator communities were mainly represented by small and medium-sized, predators, saprophagous and florivorous, no-social, and no-nesting species. Pollinators in *Rhizophora mangle* were very scarce, meanwhile, *Conocarpus erectus* denoted a trend of niche differentiation, *Avicennia germinans,* and *Laguncularia racemosa* had similar functional compositions. Overall pollinator's abundance and richness did not change by mangrove patch area or landscape composition. However, the richness of ground-nesting wasps decreased, while the degree of specialization increased with mangrove patch areas. Urban areas negatively affected predators, big-sized species, and ground-nesting wasps. Changes in cropland areas surrounding mangrove forests did not affect the abundance, richness, and functional composition of mangrove pollinators, therefore, the implication of interaction network will be discussed in a conservation context.

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Keywords: Landscape diversity, habitat loss, urbanization, interaction networks

*Corresponding author: paulammpfeiffer@gmail.com
†Speaker

Cutting the knot: Untangling a paraphyletic Eristalinae (Diptera: Syrphidae) using phylogenomics

Kevin Moran *† [1], Jeffrey H. Skevington [2], Scott Kelso [2], Ximo Mengual [3], Andrew Young [4]

[1] Carleton University – Canada
[2] Agriculture and Agri-Food Canada, Canadian National Collection of Insects, Arachnids and Nematodes, K.W. Neatby Building, 960 Carling Avenue, Ottawa, Ontario, K1A 0C6 – Canada
[3] Zoologisches Forschungsmuseum Alexander Koenig, Leibniz-Institut zur Analyse des Biodiversitätswandels, Adenauerallee 127, D-53113 Bonn – Germany
[4] University of Guelph – Canada

Next generation sequencing, in combination with the dataset preparation pipeline PhyMMR, cuts through the stubborn knot represented by the paraphyletic subfamily Eristalinae (Diptera: Syrphidae) to reveal a new hypothesis of Syrphidae relationships. Eristalinae is revealed as a paraphyletic assemblage of five monophyletic clades: Eristalinae, Merodontinae, Cerioidinae, Volucellinae and Alipumilinae.

The study utilizes probes developed specifically for use with Syrphidae and samples 1302 orthologous genes. 136 of 145 described genera within Eristalinae are sampled, with the use of pinned museum specimens allowing for inclusion of rarer genera, for a total sampling of more than 300 taxa.

Multiple independent Australian-Chilean relationships are revealed, raising the question of whether Syrphidae underwent Trans-Antarctic dispersal or Gondwanan vicariance.

*Speaker
†Corresponding author: syrphidae@kevinmoran.com

Phenological change in Britain's hoverflies

Roger Morris *† [1], Stuart Ball [1] *

[1] Hoverfly Recording Scheme – United Kingdom

Climate warming has resulted in shorter winters and warmer summers; changes to which Britain's hoverflies have responded in several ways. The most obvious change has been in the timing of species' emergence with many species occuring earlier in the year. The scale of phenological change is not uniform. Our analysis shows that, amongst normally univoltine species, the earliest-emerging species have not responded as dramatically as species that used to emerge in mid-April through to mid-May.

Phenological change is strongly related to both longitude and latitude, being most pronounced in south-east England and weakest in northern and western Scotland. Species that emerge later in the spring tend to have advanced timing to a lesser extent, whilst those that emerge after the middle of June seem not to have advanced their timing at all.

In this talk, we will use a series of examples to demonstrate the detected changes, based on both linear and quantile regression. This will include a visualisation of the pace of change in *Epistrophe eligans* over the decades 1980-2021.

Keywords: Phenology, climate change

*Speaker

†Corresponding author: syrphid58@gmail.com

Hoverflies and climate change - making sense of trends

Roger Morris *† [1], Stuart Ball [1] *

[1] Hoverfly Recording Scheme – United Kingdom

Evidence of substantial declines in both the abundance and biomass of invertebrates is now incontrovertible, with important results generated from several data sources in northern Europe. The effects on 'pollinator' populations gain particular attention, and as such there is a lot of interest in what is happening to the Syrphidae. Possible reasons for these trends include traditional reasons such as agricultural intensification and pesticide usage. We suspect, however, that whilst these have been important drivers of invertebrate declines, other factors are likely to be increasingly influential.

Climate change is the big unknown. It is relatively easy to link climate warming to range expansion in some species such as at least two *Volucella*; it is far harder to explain why other species' range or abundance is changing. Detecting these changes is problematic because very few datasets exist, and those that are available have not been assembled in a way that allows direct linkage to climate variables. Nevertheless, we believe that many species that are responding negatively to climate change. Using examples, we highlight the potential importance of the Syrphidae as the focus of research. The tremendous range of larval lifestyles is an important consideration in this respect.

In this presentation, we construct a conceptual model based on Syrphid life-histories to explain at least some of the changes that have been detected in invertebrate abundance. Our model emphasises the importance of extreme events as the driver of change. We liken them to 'death by a thousand cuts', placing the greatest emphasis on heatwaves and droughts, whilst recognising that other extreme weather such as warm winters and flash flooding will (at least) have localised effects.

Keywords: Decline, climate change, conceptual model, larval biology

*Speaker

†Corresponding author: syrphid58@gmail.com

Poster N° 21

Diversity of hoverflies (Diptera: Syrphidae) in three habitat types in the Karkloof, KwaZulu-Natal, South Africa

Luhlumelo Mva* [1,2], Timo van der Niet [2], Kurt Jordaens [3], John Midgley † [1,4]

[1] KwaZulu-Natal Museum, Pietermaritzburg, KwaZulu-Natal, 3021 – South Africa
[2] University of KwaZulu-Natal – South Africa
[3] Royal Museum for Central Africa, Invertebrates Section, Leuvensesteenweg 13, 3080 Tervuren – Belgium
[4] Department of Zoology & Entomology, Rhodes University, Makhanda, 6139 – South Africa

Hoverflies (Diptera: Syrphidae) are a diverse family and are nearly worldwide in distribution. Many species are flower-visiting insects that serve as pollinators of various agricultural and horticultural crops and wild plants. Hoverfly abundance is generally expected to vary according to vegetation types, for instance, differences in the type and diversity of floral resources, but this has not yet been investigated in South Africa. To investigate hoverfly abundance and diversity patterns in three habitats (plantation, forest and grassland), nine Malaise traps were placed at Karkloof (KwaZulu-Natal, South Africa). The traps were serviced weekly and hoverflies were identified using available keys. Diversity indices were calculated using Shannon *H'* diversity Index and Simpson *D* evenness Index. A total of 195 hoverflies belonging to 21 species, 15 genera and three subfamilies were collected. The grassland had the highest abundance of hoverflies (110) followed by the forest (66) and the plantation (19) had the least number of individuals. A similar pattern was seen in richness and diversity. Plantation showed the highest evenness followed by forest and then grassland. The results show that heterogeneous habitats, such as the grassland and forest, yield high abundance, diversity and richness of hoverflies. This may be due to the diversity in available microhabitats as well as floristic diversity which provides hoverflies with nectar and/or pollen, whereas plantation, which is a modified monoculture, lacks microhabitat and floristic diversity, and yields a low number of hoverflies, resulting in higher evenness.

Keywords: Hoverflies, habitats, diversity, abundance, Karkloof

*Corresponding author: luhlumelomva@gmail.com
†Corresponding author: jmidgley@nmsa.org.za

Poster N° 22

The North African hoverflies of the genus *Xanthogramma* Schiner, 1861 (Diptera: Syrphidae): a new species uncovered

Zorica Nedeljković [1], Antonio Ricarte* [1], Ximo Mengual [2]

[1] Research Institute CIBIO (Centro Iberoamericano de la Biodiversidad) Science Park. University of Alicante. Ctra. San Vicente del Raspeig s/n. 03690-San Vicente del Raspeig (Alicante). – Spain
[2] Zoologisches Forschungsmuseum Alexander Koenig, Leibniz-Institut zur Analyse des Biodiversitätswandels, Adenauerallee 127, D-53113 Bonn – Germany

The hoverfly fauna of North Africa, understood as the territory comprised from Egypt on east to Morocco on west and bordered in the south by the Sahara Desert, is poorly and unevenly known. The genus *Xanthogramma* Schiner, 1861 (Syrphinae: Syrphini) is represented in this region by a few records of four species, *Xanthogramma dives* (Rondani, 1857), *Xanthogramma evanescens* Becker & Stein, 1913 (endemic to North Africa), *Xanthogramma marginale* (Loew, 1854) and *Xanthogramma pedissequum* (Harris, 1776). After examination of old *Xanthogramma* material collected in Tanger, Morocco (=type locality of *X. evanescens*) from the 'Museo Nacional de Ciencias Naturales, Madrid (MNCN)', specimens with distinctive morphology were spotted and found to be different from a syntype of *X. evanescens*. Consequently, we revised all the material of *Xanthogramma* from North Africa available to us, characterised a new species from Morocco, proposed a lectotype for *X. evanescens*, and provided an identification key to the North African species of this genus. The new species differs from *X. evanescens* in characters such as the facial width, colouration of proepimeron and katepisternum, length of mesonotum pile and wing microtrichia.

We would like to thank Mercedes París García (MNCN), Sven Marotzke ('Museum für Naturkunde', Berlin, Germany), Sihem Djellab ('Université Larbi Tebessi', Algeria), Gunilla Ståhls (Finnish Museum of Natural History) and Martin Ebejer (National Museum of Wales, UK) for arranging the loan of specimens, and the 'Vicerrectorado de Investigación y Transferencia del Conocimiento', for funding Antonio Ricarte's position at the University of Alicante (UATALENTO17-08).

Keywords: *Xanthogramma*, new species, identification key, North Africa, Morocco

*Corresponding author: ricarte24@gmail.com

Poster N° 23

Hoverflies (Diptera: Syrphidae) in the Diptera Eastern Fennica collections of the Finnish Museum of Natural History Luomus

Tapani Neuvonen [1], Jere Kahanpää [1], Gunilla Ståhls [1]

[1] Finnish Museum of Natural History Luomus – Finland

The holdings of Syrphidae in the Diptera Eastern Fennica collections of the Natural History Museum of Helsinki have been inventoried during 2022. The collection contains over 55,000 specimens of 364 species belonging to 73 genera. The history of the collection is briefly presented, and the number of individuals of each species are listed, with rough estimates of the most numerous species and the unidentified materials.

Keywords: scientific collections

Poster N° 24

List of the Syrphidae of Bouches du Rhône, France

Gabriel Nève* [1], Samuel Hilaire [2], Arnaud Klein [3], Xavier Lair [3], Christophe Lauriaut [3], Thomas Lebard [3], Jean-Yves Meunier [1], Lise Ropars [1,4]

[1] Institut méditerranéen de biodiversité et d'écologie marine et continentale (IMBE), Aix Marseille Université, IRD, CNRS, Avignon Université, Marseille – France
[2] La Tour du Valat, Arles – France
[3] Independant entomologist – France
[4] Muséum National d'Histoire Naturelle, Paris – France

Until recently, the documented Syrphidae fauna of Bouches-du-Rhône amounted to only 49 species (Speight *et al.* 2018), with obvious missing species, such as *Episyrphus balteatus*. An examination of the collections of Jean Timon-David (1902-1968) and Louis Bigot (1927-2021) at the Marseille Natural History Museum, inclucing the reidentification of all their Bouches-du-Rhône specimens revealed a further 59 species, including some previously overlooked species (e.g. *Merodon legionensis*) or species now rare, such as *Caliprobola speciosa* and *Criorhina floccosa*.

Field work by the authors (Ropars *et al.* 2020 ; Solère *et al.* 2022 ; unpublished data) mainly over the last 10 years, with over 10,000 specimens, has increased the list further to 140 species. The up to date list is presented. Some species mentionned only in old literature (e.g. Séguy, 1961) need confirmation. More species are still expected to occur.

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Keywords: Louis Bigot, Jean Timon-David, collection, Museum, Syrphidae, list, Bouches-du-Rhône

*Corresponding author: gabriel.neve@imbe.fr

Poster N° 25

Morphology of the first early stages of *Milesia* ever found in Europe.

José Orengo-Green * [1], Antonio Ricarte [1], Javier Quinto [2], Mª. Ángeles Marcos-García [1]

[1] Research Institute CIBIO (Centro Iberoamericano de la Biodiversidad) Science Park. University of Alicante. Ctra. San Vicente del Raspeig s/n. 03690-San Vicente del Raspeig (Alicante). – Spain
[2] Instituto de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica, Centro IFAPA de Málaga, Laboratorio de Entomología Agrícola, Málaga – Spain

With more than 80 species, the genus *Milesia* Latreille, 1804 (Diptera: Syrphidae) is found in almost every continent. Little is known about the immature stages of *Milesia* and their breeding site. However, the three *Milesia* species for which early stages are known confirm that *Milesia* larvae are saproxylic in rot holes. The larvae of the two species of *Milesia* occurring in Europe are unknown. One of these two species, *Milesia crabroniformis* (Fabricius, 1775), is the largest hoverfly in Europe and mimic the hornet, *Vespa crabro* Linnaeus, 1758. This species is widespread in the Iberian Peninsula and adults are usually found in association with mature forest. We here report the first finding of a *M. crabroniformis* early stage in the Palearctic Region. Specimens were collected in rot holes of live chesnut (*Castanea sativa* Mill.) in Sierra de las Nieves, Málaga, southern Spain. Larvae were identified by rearing them to adult stage in laboratory conditions. The morphology of the second and third larva stages and puparium were described by using both stereomicroscope and scanning electron microscope (SEM) techniques. The puparium of *M. crabroniformis* is compared with those known to other *Milesia* species. This research belongs to the Fauna Ibérica project (PGC2018-095851-A-C65) of the Spanish Ministry of Science, Innovation and Universities, as well as to the UATALENTO17-08 of the "Vicerrectorado de Investigación y Transferencia del Conocimiento", University of Alicante.

Keywords: Chaetotaxy, chestnut tree, hoverfly, larva, puparium, saproxylic

*Corresponding author: jj.orengo@ua.es

Poster N° 26

The hoverflies (Diptera: Syrphidae) of the Querco-Castagnetum forests in the area of the candidate Locarnese National Park

Lucia Pollini Paltrinieri * [1], Isabella Forini-Giacalone [2], Bärbel Koch [1]

[1] Museo cantonale di storia naturale, Lugano – Switzerland
[2] Independant Researcher, Monte Carasso – Switzerland

Since 2018, the "Working Group Sirfidi Ticino" has promoted a series of researches on the Syrphidae in Canton of Ticino (Switzerland). One of these researches investigated, by using the Syrph the Net (StN) methodology, three Querco-Castagnetum survey sites in the Locarnese region. Both woodland and open areas macrohabitats were surveyed. During the sampling between April and November 2018 with 6 Malaise traps, 1'353 hoverflies belonging to 73 species were collected, about a quarter of the syrphid known so far for Ticino. Forty per cent of these species are classified as threatened or declining at European and/or Swiss level. One species, *Merodon gallicus* Vujić & Radenković, 2012, was observed for the first time in Switzerland and eight other species for the first time in Canton Ticino. Analyses using the StN method show an insufficient biodiversity maintenance function (BDMF) of the investigated habitats as a whole, corresponding to 36%. The habitat with the most complete hoverfly community is the *Castanea* forest, with a very good BDMF value of 76%, while that of the acidophilous *Quercus* forest is only moderate (48%). In general, the results young age of the forests due to the intense past management of these areas was highlighted. Despite the deficits evidenced, the investigated forests show a high proportion of threatened or declining species and their importance in the conservation of species considered rare is undeniable.

Keywords: biodiversity, Switzerland, Syrph the Net

*Corresponding author: lucia.pollini@ti.ch

Catalogue of the Syrphidae of Ukraine: an annotated checklist, with distributions and bibliography

Grigory Popov *† [1], Viktor Shparyk [2], Alex Prokhorov [1], Iryna Lezhenina [3], Ruslan Mishustin [4], Anastasia Lishchuk [5]

[1] I. I. Schmalhausen Institute of Zoology, National Academy of Science, Kyiv – Ukraine
[2] V. Stefanyk Precarpathian National University, Ivano-Frankivsk – Ukraine
[3] V. V. Dokuchayev Kharkiv National Agrarian University – Ukraine
[4] Kherson State University – Ukraine
[5] "Podilski Tovtry" National Nature Park, Kamyanets-Podilsky – Ukraine

A total of 408 species of Syrphidae have been reliably registered in Ukraine, as well as another 30-50 taxa, the records of which have not been confirmed by modern material. The Ukrainian hoverfly fauna has one endemic (*Merodon dzhalitae* Paramonov, 1926: the Crimean Peninsula) and two subendemic species with narrow ranges (*Merodon alexandri* Popov, 2010: Ukraine and adjacent Russian regions; *Paragus medea* Stănescu, 1991: Hungary, Romania, Ukraine). At the same time, some species, such as *Chalcosyrphus jacobsoni* (Stackelberg, 1921), which have traditionally been considered present in Ukraine, are not confirmed by any old or new material. We highlight the view that national lists should be backed up by reference material for all the species. For some taxa, the publishing years of the first descriptions (namely Paramonov's papers) are still incorrectly cited. A number of taxa have the type locations in Ukraine: *Chalcosyrphus obscurus* (Szilády, 1939), Zakarpattia Region; *Eumerus tauricus* Stackelberg, 1952, the Crimea; *Merodon crassifemoris* Paramonov, 1926 (sic!), the Crimea; etc. In Ukraine, some species have a westernmost frontier in Europe, such as *Helophilus continuus* Loew, 1854 (also found in Romania and Belarus), *Mallota eurasiatica* Stackelberg, 1950, etc. Here is the southern borderline of the range for the Eastern European *Melanogaster jaroslavensis* (Stackelberg, 1922), etc. Finally, it is in Ukraine that the largest populations of the *Pseudopelecocera latifrons* (Loew, 1856) survive.

Keywords: Syrphidae, list, Ukraine

*Speaker
†Corresponding author: grigory.v.popov@gmail.com

EU Pollinator Monitoring Scheme (EUPoMS): what would be the most appropriate way to monitor Syrphidae at the European level

Snežana Radenković *† [1]

[1] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology – Serbia

Introduction to the round table

Keywords: Pollination, monitoring

*Speaker
†Corresponding author: snezana.radenkovic@dbe.uns.ac.rs

Poster N° 27

Monitoring of insect pollinators in Serbia – pilot project –

Snežana Radenković * [1], Mihajla Djan [1], Marija Miličić [2], Snežana Popov [1], Ante Vujić [1]

[1] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Novi Sad – Serbia
[2] University of Novi Sad, BioSense Institute – Research Institute for Information Technologies in Biosystems, Novi Sad – Serbia

The decline of number of insect pollinators can negatively influence the functioning of ecosystems and food security (Doyle et al. 2020). To tackle this issue European Commission established Pollinators Initiative and set up Pollinator Monitoring Scheme (EUPoMS) that becomes obligatory for all countries of EU. Unfortunately there is a significant data gap in many countries, especially in Southeast Europe (including Serbia) that should be overcome. In Serbia, the national pollinator initiative or strategy has not been established yet. Serbian Pollinator Advice Strategy (SPAS) Project has started in 2022, aiming to perform the monitoring of hoverflies, bees and butterflies on 30 sites throughout Serbia, three times annually, for three years, by transect walks and pan traps. Simultaneously, different environmental parameters potentially influencing the occupancy, diversity and abundance of pollinators (such as flower and vegetation covers, weather conditions, soil type, land use and land cover changes) are observed. In order to ensure the identification, detect cryptic species, identify conservation management units, locally declined populations and signals of genetic erosion, as well as to enrich DNA databases, pollinators collected in the field are analyzed using molecular markers. Additionally, usage of restriction-site associated DNA method (ddRAD-seq) for analyzing genome-wide sequence data from hoverflies (useful for detection of adaptive signals) is also planned. Here we will present the first results of monitoring from spring and summer seasons 2022 and the challenges we are already facing.

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Keywords: abundance, bees, butterflies, COI, ddRAD, seq, diversity, EUPoMS, hoverflies, pan trap, transect walk

*Corresponding author: snezana.radenkovic@dbe.uns.ac.rs

Poster N° 28

Predicted impact of climate change on the distribution of some phytophagous hoverfly species (Diptera: Syrphidae: Merodontini) in Montenegro - from past to future

Milica Ranković * [1], Dubravka Milić [1], Snežana Radenković [1], Tijana Nikolić [2], Suzana Malidžan [3], Ante Vujić [1]

[1] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Novi Sad – Serbia
[2] University of Novi Sad, BioSense Institute, Novi Sad – Serbia
[3] Natural History Museum of Montenegro, Podgorica – Montenegro

Global climate changes have a significant impact on species abundance and biodiversity. In Montenegro, one of the European biodiversity hotspot areas, more than 380 hoverfly species have been registered (Malidžan pers. comm.). According to few previous studies, climate changes have a negative impact on most of analyzed phytophagous species1,2. In order to investigate climate change's impact on some species from genera *Eumerus* Meigen, 1822 and *Merodon* Meigen, 1803 of Montenegro, we analyze their potential past and current distribution, and their potential response to future climate change scenarios. Three climate models (CNRM-CM5, HadGEM2-ES, IPSL-CM5A-LR) were applied for past and five climate models (CNRM-CM5, HadGEM2-ES, IPSL-CM5A-LR, MPI-ESM-LR, NORESM1-M) for future climate prediction. According to our results, most of analyzed species could increased their potential distribution during the past to present timeframe. On the other hand, future predictions lead to decreasing in distribution for most of the studied species, except *Eumerus amoenus*, which would potentially increase its distribution in the future. As our results indicate that climate change can have a potentially negative effect on the distribution of these species in the future, in order to protect and preserve them, additional conservation measures should be considered.

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Keywords: Maxent, Climate models, Insects, Biodiversity

*Corresponding author: milica.r@dbe.uns.ac.rs

Next generation sequencing reveals a new hypothesis of Microdontinae relationships

Menno Reemer *† [1], Kevin M. Moran [2,3], Jeffrey H. Skevington [2], Scott Kelso [2], Ximo Mengual [4]

[1] Naturalis Biodiversity Center [Leiden] – The Netherlands
[2] Agriculture and Agri-Food Canada, Canadian National Collection of Insects, Arachnids and Nematodes, K.W. Neatby Building, 960 Carling Avenue, Ottawa, Ontario, K1A 0C6 – Canada
[3] Carleton University, Department of Biology, 1125 Colonel By Drive, Ottawa, Ontario, K1S 5B6 – Canada
[4] Zoologisches Forschungsmuseum Alexander Koenig, Leibniz-Institut zur Analyse des Biodiversitätswandels, Adenauerallee 127, 53113 Bonn – Germany

The subfamily Microdontinae is a cosmopolitan group of ant-associated hoverflies. Phylogenetic relationships of the more than 500 described species are unclear. Until recently, more than 300 species were classified in *Microdon*. Reemer & Ståhls (2013) published the first phylogenetic study dealing specifically with Microdontinae. Yet many relationships remained uncertain or unresolved, in part because many taxa were unavailable for molecular study.
In the study, new techniques were used to extract DNA from pinned museum specimens, which allowed for the inclusion of rarer taxa. The study utilizes probes developed specifically for use with Syrphidae and samples 1302 orthologous genes. 91 taxa, including specimens from all six biotic regions, were sequenced.
A new hypothesis of Microdontinae relationships is presented with the resulting tree compared to those that came before. Paraphyly in the tree is discussed. Other aspects that will be discussed are potential implications for classification, interesting biogeographic patterns, and evolutionary history.

Keywords: Microdontinae, phylogeny, taxonomy, classification

*Speaker
†Corresponding author: menno.reemer@naturalis.nl

European Project SPRING: "Strengthening Pollinator Recovery through INdicators and monitorinG": challenges and opportunities for hoverflies in the Spanish EUPoMS. (Diptera: Syrphidae)

Santos Rojo * [1], Celeste Pérez-Bañón [1], Andrea Aracil [1], Guillermo Bañares-de-Dios [2], Elena Bermejo [2], Estrella Yanguas-Fernández [2], Pablo Núñez [2], Guillermo Cabezas [3], Paula Romero [3], Noelia Vallejo [3]

[1] Department of Environmental Sciences & Natural Resources; University of Alicante, PO Box. 99, E-03080 Alicante – Spain
[2] Management of Quality, Environmental Assessment, and the Natural Environment Department; TRAGSATEC, Julián Camarillo Street, 6B E-28037, Madrid – Spain
[3] Subdirectorate General for Terrestrial and Marine Biodiversity; Directorate General for Biodiversity, Forests and Desertification; MITECO (Spanish Ministry for the Ecological Transition and the Demographic Challenge), San Juan de la Cruz Square, 10 E-28071, Madrid – Spain

The Expert proposal for an EU Pollinator Monitoring Scheme (EUPoMS), includes, among other aspects, a general methodology for monitoring pollinating insect populations (mainly bees, bumblebees, butterflies, and hoverflies) also considering the framework of the EU Common Agricultural Policy. Later, the European Commission promote, in collaboration with national authorities, on the fine-tuning and operationalisation of the proposal for the implementation of the EUPoMS i.e., the EU Pollinator Monitoring Scheme (Potts et al., 2020). Among other actions, in June 2021, the Commission launched the SPRING (Strengthening Pollinator Recovery through Indicators and Monitoring) project, with the key purpose of suppor- ting the preparation of the implementation of the EU Pollinator Monitoring Scheme and testing the scheme on a pilot scale in all 27 EU countries (`https://www.ufz.de/spring-pollination`).

In this context, the Programme for the improvement of knowledge of pollinating insects has recently been launched in Spain. Therefore, the MITECO (Ministry for Ecological Transition and the Demographic Challenge) is developing a project to improve the acquisition and reinforcement of knowledge of the state and trends of pollinating insect populations in Spain. This project is being developed within the framework of the National Strategy for the conservation of pollinators, adopted in September 2020, and follows with special interest the results of the development of the SPRING project in order to achieve the implementation of the Spanish EUPoMs in accordance with the rest of the EU countries. This work presents the preliminary results of the project and the main challenges to be overcome, as well as different proposals for discussion in the context of monitoring syrphids as pollinators in Spain.

Reference

Potts, S., et al. 2020., Proposal for an EU Pollinator Monitoring Scheme, EUR 30416 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-23859-1, doi:10.2760/881843, JRC122225.

Keywords: EUPoMS, pollinators, monitoring, SPRING, Spain

*Speaker

Landscape and local drivers influence on syrphids of fennel crops in Provence and implications for its yield

Lucie Schurr *† [1], Gabriel Nève [1], Véronique Masotti [1], Laurence Affre [1], Sophie Gachet [1], Benoît Geslin [1]

[1] Institut méditerranéen de biodiversité et d'écologie marine et continentale (IMBE), Aix Marseille Université, Institut de recherche pour le développement (IRD), CNRS, Avignon Université, Marseille – France

In the context of insect decline [1], their importance for food production is well-known [2–5] but the insect-pollinator dependence for aromatic plants remains piecemeal. Aromatic fennel (*Foeniculum vulgare*) is cultivated for the trans-anethole essential oil used in anise drinks. We characterized the dependence of fennel crops on insect pollination and fruit set, essential oil and trans-anethole yield according to insect presence, abundance and richness.

In a comprehensive study, we first showed that, at the crop level, insect pollination improved the reproduction and the amount of trans-anethole in fennel. We showed that the amount of essential oil per hectare increased with the richness of insects. We investigated the influence of landscape and agricultural practices on fennel-flower-visitors and found that landscape configuration and proximity to semi-natural habitat were the main drivers of their richness. Once again, our results underline the importance of preserving insect biodiversity to enhance food production and meet food security, which are key challenges of our century [6,7].

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Keywords: Fennel, landscape heterogeneity, insecticide, syrphid abundance and richness, yield.

*Speaker
†Corresponding author: lucie.schurr@imbe.fr

Revision of Australian Syrphidae

Jeffrey Skevington * [1]

[1] Agriculture and Agri-Food Canada – Canada

I will present an overview of the state of Australian Syrphidae taxonomy with a focus on a revision of *Triglyphus* that I am currently working on. Only a single species has been described but there are many undescribed species in this genus.

Keywords: taxonomy, *Triglyphus*, Australia

*Speaker

Hoverflies (Diptera Syrphidae) in the Alpine National Parks of Italy

Daniele Sommaggio * [1]

[1] University of Bologna – Italy

In 2019, the Italian ministry promoted a project aimed at increasing the knowledge of main pollinator taxa and at planning a monitoring scheme to evaluate the long term trend of pollinators. The project was carried out in the 25 national parks and focuses mainly on three taxa: butterflies (Lepidoptera: Papillionoidea), bees (Hymenoptera: Anthophila) and hoverflies (Diptera: Syrphidae). The University of Bologna has been involved in studying the hoverflies in the four Alpine National Parks: Dolomiti Bellunesi, Gran Paradiso, Stelvio and Val Grande. The specific objectives are different according to the peculiarities and needs of each park. All Parks are interested in increasing the knowledge about their hoverfly fauna. In the Dolomiti Bellunesi National Park in 2019 and 2020, Syrphidae were sampled using Malaise traps, pan traps and collections with entomological net. Overall, 185 species of hoverflies were recorded within this Park, which can be considered as an important hotspot of biodiversity. This checklist was used to apply Syrph the Net to the whole territory of the Park, focusing on the potential habitats with the greatest difficulties for nature conservation. Val Grande National Park is developing a project similar to that of the Belluno Dolomites, with field activities in 2021 and especially 2022. In addition in these two parks the altitudinal distribution of bees and hoverflies was studied using pan traps as sampling methods. In Dolomiti Bellunesi National Park altitude is the main variable explaining the distribution of bees and hoverflies, which showed different distribution patterns: hoverflies have a unimodal distribution (richness and abundance) with peak at middle altitude (1500 m), while bees have a monotonic decline (richness and abundance) with increasing altitude. To evaluate the efficiency of hoverfly species as pollinators, a project has been started, involving the collection and identification of the pollen transported by metagenomics; this research has been developed in Dolomiti Bellunesi and Val Grande National Parks. In the Gran Paradiso National Park, a research has been promoted with the aim to study the effect of low-impact grazing of asses on the fauna of invertebrates, and in particular on pollinators, since 2016. In each pasture, a plot of 40 x 40 m was delimited where asses were prevented from grazing (control). Invertebrates were sampled using emergence traps; in addition hoverflies were sampled using entomological nets along a transect. Invertebrate abundance was significantly higher in grazed plots than in ungrazed one; this trend was confirmed for detritivore and parasitoids. No family of insects was significantly more abundant in ungrazed than in grazed plots. Specimens belonging to 10 families (including Syrphidae) were identified to species level and no difference in species richness among plots were recorded. The application of PERMANOVA allowed to detect no difference between grazed and ungrazed plots for the studied taxa. Starting from 2022 in the Alpine National Parks, four transects have been identified where butterflies, bees and hoverflies will be identified and counted. Although the sampling protocol is still being defined, these transects will represent permanent sampling points aimed at evaluating, in conditions of low anthropogenic impact, the long-term changes in the pollinator community.

Keywords: Alpine Parks, Syrph the Net, conservation, grazing

*Speaker

Overview of knowledge of hoverfly decline (Diptera: Syrphidae) in Germany

Axel Ssymank *† [1]

[1] Bundesamt für Naturschutz – Germany

Since Hallmann's study on insect biomass decline in 2017 hoverflies from a series of six Malaise traps served as example how closely related biomass decline is to species and abundance decline (Hallmann et el. 2021). Additional results from other trap series of northwest Germany are now available, however the degree of decline shows marked regional differences. New results from other Federal research projects such as DINA and a research project in Bavaria give additional insights in hoverfly decline. Major reasons are attributed to modern agriculture with pesticides and large intensive monoculture. The overview will include a short comparison of major threats identified by the German and the EU Red lists.

Keywords: Syrphidae, decline, Germany, Red list status

*Speaker
†Corresponding author: ssymanka@t-online.de

Taxo-Fly project – a EU funded Service Contract to generate Taxonomic Resources for European hoverflies

Gunilla Ståhls *† [1], Ante Vujić , Snežana Radenković , Axel Ssymank , Libor Mazánek , Ximo Mengual , Jeroen van Steenis , Marija Miličić , Tamara Tot , Ana Grković , Laura Likov , Marina Janković , Martin Speight , Aino Juslén

[1] University of Helsinki, Finnish Museum of Natural History, Helsinki – Finland

The overall aim of the Taxo-Fly project is to generate Taxonomic Resources for European hoverflies by identifying and capturing most important taxonomic and other information (ecology, distribution) for the hoverflies of Europe, and making these data available on the web in a well-structured, coherent and consistent way. The taxonomic resources generated within this project will constitute an important basis for future digital (web) tools, e.g. available for use in both European and regionally adapted identification keys important for the EU PoMS. High-quality digital images generated within the project will constitute a new resource of standardized hoverfly images, with diagnostic characters clearly portrayed and indicated. The Core team to generate the taxonomic information has 14 members, and is supported by an external expert team with six members. The background and recent developments of the project will be presented.

Keywords: Taxo-Fly, taxonomy, identification

*Speaker
†Corresponding author: gunilla.stahls@helsinki.fi

Poster N° 29

Characterization of cryptic diversity within *Paragus bicolor* complex (Diptera: Syrphidae, Syrphinae, Paragini)

Tamara Tot [1], Jelena Ačanski [2], Snežana Radenković [1], Zorica Nedeljković [3], Ana Grković [1], Ante Vujić [1]

[1] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Trg Dositeja Obradovića 2, 21000 Novi Sad – Serbia
[2] University of Novi Sad, BioSense Insitute, Dr Zorana Đinđića 1, 21000 Novi Sad – Serbia
[3] Research Institute CIBIO (Centro Iberoamericano de la Biodiversidad). Science Park. University of Alicante. Ctra San Vicente del Raspeig s/n. 03690-San Vicente del Raspeig (Alicante) – Spain

Identification of adult specimens belonging to the *Paragus bicolor* group, of the genus *Paragus* Latreille, 1804 is difficult due to the high degree of variability in the color of the abdomen. In the present literature *Paragus bicolor* (Fabricius, 1794) and *Paragus romanicus* Stanescu, 1992 are cited as valid species of *Paragus bicolor* complex, while *Paragus testaceus* Meigen, 1822 is cited as junior synonym of *Paragus bicolor*. After detailed morphological analysis, including geometric morphometry of the wing and male surstyle, existence of four cryptic species within *Paragus bicolor* complex has been confirmed. Besides *Paragus bicolor*, also *Paragus testaceus* proved to be a valid one and should be reinstated from the status of synonyms. Contrary to previous ones, *Paragus romanicus* lost this status and should be synonymized with *Paragus bicolor*. Additionally two new species have been revealed.

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Keywords: cryptic species, hoverflies, male genitalia geometric morphometrics, *Paragus*, species complex, wing geometric morphometrics

Working towards a checklist of Bulgarian hoverflies

Leendert-Jan van der Ent * [1], Wouter van Steenis [2] , Jeroen van Steenis [3] , Menno van Zuijen [4]

[1] Sara Mansveltweg 19, 6874 CB, Wolfheze – The Netherlands
[2] Vrouwenmantel 18, 3621 TR Breukelen – The Netherlands
[3] Syrphidae Foundation, Hof der Toekomst 48, 3823HX Amersfoort – The Netherlands
[4] Kolkakkerweg 21-2, NL-6706 GK Wageningen – The Netherlands

Bulgaria is, amazingly, one of the last countries in Europe without a proper hoverfly checklist. Based on literature data and additional country records from the European Red List of hoverflies (`https://www.iucnredlist.org`), a list of 383 Bulgarian hoverflies was composed. This is 80 more than was published recently in a compilation of all Bulgarian Diptera species based on primarily Bulgarian literature. However, many of these species records are old (1970) and not all parts of Bulgaria have been investigated. For an up-to-date checklist we need more and especially recent data. The first author visited Bulgaria in 2019 and collected some additional species from Rila and Pirin mountains. In spring 2022 (May 22- June 5), a hoverfly collecting trip was conducted visiting parts of Strandza NP, Eastern and Western Rhodopes and the surroundings of Sofia. So far, from this trip, more than 200 hoverfly species have been identified, at least 20 are new species records for Bulgaria. We will present the results at the symposium, and we ask you to collaborate if you have any records of Bulgarian hoverflies. The coming years we plan to identify all Syrphidae in the collection of the National Museum of Natural History in Sofia. Additionally, we will organise more collections trips to Bulgaria. Within a few years we expect to present a comprehensive checklist of an estimated number of 450 to 500 species which is about half the number of European hoverfly species.

Keywords: Bulgaria, checklist, collecting trips

*Speaker

Poster N° 30

Hoverfly (Diptera: Syrphidae) adult terminology: an update and extension

Jeroen van Steenis [1], Tamara Tot [2] , Ximo Mengual [3] , Sander Bot [1] , Gil Miranda [4] , Jeffrey Skevington [5]

[1] Independant Researcher – The Netherlands
[2] University of Novi Sad – Serbia
[3] Zoologisches Forschungsmuseum Alexander Koenig, Bonn – Germany
[4] Instituto Nacional de Pesquisas da Amazônia – Brazil
[5] Agriculture and Agri-Food Canada – Canada

An updated morphological terminology for adult Syrphidae (Insecta, Diptera) is presented. For some parts, new terms are introduced to more accurately describe the different body parts of Syrphidae. The need for an update and extension of the terminology became evident while preparing species descriptions for the European Union funded Taxo-Fly project on European Syrphidae. The focus of this paper was on European species, although some features have been illustrated based on species from other biogeographic regions. The main part consists of the many figures depicting the different body parts with terminology indicated in each figure. A glossary of all terms used is given in alphabetical order for each body part. The glossary starts with a list of general terminology for the external morphology of adults. A short description for each term is given, together with additional information like synonymous terms.

Keywords: Syrphidae, morphology, new terminology, glossary of terms

Introducing *Journaal van Syrphidae*

Jeroen van Steenis *† [1], Leendert-Jan van der Ent , Francis Gilbert , Roger Morris , Gerard Pennards , Tsung-Hsueh Wu , Axel Ssymank

[1] Independant Researcher – The Netherlands

An invitation to submit articles for publication in the "Journal of Syrphidae". This is a new and completely free electronic journal (`https://www.syrphidaeintrees.com/jvs/`) launched as part of the Syrphidae Foundation (`https://www.syrphidaeintrees.com/syrphidae-foundation/`). It will cover all aspects of worldwide Syrphid taxonomy, ecology and conservation. The articles, in English, will be published continuously and thus each article constitutes its own volume. A unique DOI number will be generated for each article and, if necessary, also registered with Zoobank to comply with the rules of the ICZN. The publications will be available at `https://www.syrphidaeintrees.com/` and via Crossref (`https://www.crossref.org/`), ensuring that papers are appropriately archived. For more information, or to make a donation, please visit the *JvS* website or send an email to: `infojvs`syrphidaeintrees.com .

Keywords: new journal, Syrphidae, electronic, free

*Speaker
†Corresponding author: jvansteenis@syrphidaeintrees.com

A European Monitoring Scheme for Syrphidae and other pollinators.

Wouter van Steenis * [1]

[1] Independant Researcher – The Netherlands

In 2018, the European Commission adopted an EU initiative on wild pollinators. The main objectives are improving knowledge of pollinator decline, tackling the causes of pollinator decline and raising awareness and promoting collaboration. The groups involved are butterflies, bees, hoverflies and moths.

Under the initiative, three actions regarding hoverflies have started:

- European Red List of Syrphidae (see presentation of Ante Vujić)

- A database of all European Syrphidae with illustration and descriptions (Taxofly)

- The set-up of a Pollinator Monitoring Scheme (POMS) in all EU countries. This is granted under the SPRING project. My presentation will deal with POMS / SPRING.

This year is the start of the pilot period. There is a general idea of site monitoring based on transects (10x50 m) for butterflies, bees, and hoverflies, combined with 10 yellow pan traps. One 'site' is defined as a square km. there is also a side project with malaise traps.

I will present some of the first Dutch results and some of the difficulties concerning monitoring of hoverflies as an input for a round table discussion.

Keywords: European pollinator monitoring scheme North West Europe

*Speaker

The European Red List of Hoverflies – challenges and opportunities

Ante Vujić * [1]

[1] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology, Novi Sad – Serbia

European Red List of Hoverflies is an output of the Hoverfly Specialist Group of the IUCN Species Survival Commission, 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 the conservation status of the 892 European species of hoverflies (Diptera: Syrphidae), evaluated according to the IUCN Red List Categories and Criteria. Overall, 37.2% (314 species) of the European hoverfly species assessed in this study were considered threatened (assessed as CR, EN or VU) in Europe, with one species classified as Regionally Extinct (RE). A further 6.9% (61 species) are considered Near Threatened and 52.7% (469 species) are assessed as Least Concern. For 5.1% (45 species) there was insufficient information available to be able to evaluate their risk of extinction, and thus they were classified as Data Deficient (DD). The main threats to European hoverflies were found to be the impacts of intensive agriculture (including extensive livestock farming and ranching), commercial/productive forestry, residential and commercial development (tourism development and housing development), and natural system modifications (such as fires, exacerbated by climate change, and the exploitation of water sources for dams or use in agriculture). European Red List of Hoverflies provides the first comprehensive, region-wide assessment of hoverflies, and identifies species threatened with extinction at the European and EU27 Member State levels so that appropriate policy measures and conservation actions can be taken to improve their status, based on the best available evidence (Vujić *et al.* 2022). The aim of this contribution is to present the main results and highlight challenges and opportunities during and after project realization.

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Keywords: IUCN, Red List, Europe, European Commission, threatened species

*Speaker

Current status of the new syrphidae.com website

Bastiaan Wakkie * [1]

[1] Independent Researcher – Belgium

A presentation of the current status of `www.syrphidae.com` will be given : a central Syrphidae hub with world coverage, thousands of new natural photos, almost all literature from 1758 till now and searchable, all published Syrphidae names and their synonymy. A new Social platform (forum, members, symposia?, etc). What has been done, what needs to be done and what would we like to have in the future?

Keywords: Syrphidae

*Speaker

Poster N°31

16S rRNA gene sequence based *Wolbachia* screening in *Merodon* hoverflies

Ljiljana Šašić Zorić* [1], Sanja Veselić [2], Milomir Stefanović [3], Gunilla Ståhls [4], Mihajla Djan [2], Ante Vujić [2]

[1] University of Novi Sad, BioSense Institute – Serbia
[2] University of Novi Sad, Faculty of Sciences, Department of Biology and Ecology – Serbia
[3] Polish Academy of Sciences, Museum and Institute of Zoology – Czech Republic
[4] University of Helsinki, Finnish Museum of Natural History – Finland

Wolbachia is a genus of bacterial endosymbionts found in arthropods and nematodes with the broadest range of host reproductive phenotypes. It can affect the pathways through which mitochondria are inherited and influence mitochondrial variation, including DNA barcodes. This way *Wolbachia* can compromise mitochondrial gene-based identification system. The first record of *Wolbachia* in *Merodon* hoverflies was published in Šašić Zorić et al. (2019) when the COI-based relationships of the *M. aureus* species group were discussed in the light of infection. Assuming that *Wolbachia* has effects on COI sequence variability, in this study we aimed to introduce *Wolbachia* screening as an integral part of the multilocus DNA barcoding procedure for hoverflies. The screening was based on 16S rRNA gene sequences and was an integral part of the study dedicated to development of NGS based multilocus DNA barcoding for *Merodon* hoverflies. Sequencing was performed on Illumina's MiSeq sequencing platform. The amplicon sequence variants (ASVs) approach was used to recover the exact biological sequences. The results showed that *Wolbachia* was present in 40 *Merodon* species, while 16S sequences were not recovered for 20 species. Thus, the infection rate was 66.7 %. Additionally, nine *Wolbachia* positive species had multiple 16S haplotypes, up to eight in *M. unicolor*. Multiple 16S haplotypes indicate possible infection by multiple *Wolbachia* strains, however without sequencing *Wolbachia* multilocus sequence typing (MLST) genes and comparison with PubMLST database (https://pubmlst.org) it is not possible to determine strains. Based on the results we can conclude that *Wolbachia* is present in many *Merodon* species and this should be taken into account when delimiting and identifying *Merodon* species.

Keywords: bacterial endosymbiont, DNA barcode compromised, NGS

*Corresponding author: ljsasic@biosense.rs

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