PROGRAMME
&
BOOK OF ABSTRACTS

MYTILENE 2019

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Congress Venue

Department of Geography, University of the Aegean, University Hill, 81100, Mytilene, Greece

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TABLE OF CONTENTS

WELCOME

Dear fellow Syrphidologists and Entomologists,

It is a great pleasure to invite you all to attend the 10th International Symposium on Syrphidae (ISS10). The main objective of the Symposium is to bring together people interested in hoverflies, to promote the study of hoverflies, as well as to develop professional or private collaborations based on this insect group. Following the series of successful symposia of the past, we are certain that this 10th jubilee Symposium will be a scientific highlight for colleagues from all around the world. During the 18 years since the first Symposium was held in Stuttgart, great progress has been made on hoverfly research supported by strong international collaborations among many syrphidologists. As a direct result, the 10th Symposium will cover all major aspects of syrphidology, such as systematics and (integrative) taxonomy, morphology, evolution, biodiversity and conservation, biogeography, ecology etc.

We end this introduction with the words of a great hoverfly expert that speak about the current challenges for contemporary syrphidology:

"Now we have sufficient information we can begin to ponder some of the interactions between attributes of European forest syrphids and the depleted forest resource on which they depend. Doing so brings into focus challenges to our aspirations to secure the survival of these insects through the present troubled times – to be knights in shining armour charging through the pages of history, we need first to find a horse and it looks as though our armour could do with some polishing."

Martin C D Speight

The Organizing Committee

GENERAL INFORMATION

Location

Lesvos is a Greek northeastern Aegean island, embedded in the coast of Asia Minor, and as such constitutes a biological, geographical, climatic and cultural interface between Europe and Asia. Nowadays, Lesvos is separated from Turkey by the narrow Mytilene Strait, but was connected to the Anatolian mainland almost until the end of the last glacial period (in late Palaeolithic, early Mesolithic times). With an area of about 1600 km^2 and more than 300 kilometres of coastline, it is the third largest island in Greece. It has been inhabited since the Middle Paleolithic and during its more recent historical times was influenced by the Romans, the Franks, the Genoese and the Ottomans, each leaving their distinct marks. Today, Mytilene, the island's picturesque capital, is home to about one third of the total island population of about 85 000.

Venue

The ISS10 will be held in Department of Geography, University of the Aegean, University Hill, 81100, Mytilene, Greece.

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

SUNDAY 8TH SEPTEMBER 2019

16:00 – 18:00 Arrival / Registration at the front desk

18:00 Welcome drink

MONDAY 9TH SEPTEMBER 2019

08:00 – 08:30 Opening/Registration

8:30 – 8:45 Opening address

08:45 – 09:30 Plenary talk, Martin Speight

SESSION 1. SYSTEMATICS AND TAXONOMY

Chairs: **Mírian N. Morales**, **John T. Smit**

09:30 – 09:45 Ante Vujić*, Snežana Radenković, Mihajla Đan, Jelena Ačanski & Ljiljana Šašić Zorić: The future of integrative taxonomy in hoverflies

09:45 – 10:00 Jordaens Kurt*, Georg Goergen, Jeffrey H. Skevington, Scott Kelso & Marc De Meyer: A taxonomic revision of Afrotropical *Mesembrius* (Diptera, Syrphidae)

10:00 – 10:45 Coffee break

10:45 – 11:00 Snežana Radenković*, Ante Vujić, Dragana Obreht Vidaković, Mihajla Đan, Dubravka Milić, Sanja Veselić, Gunilla Ståhls & Theodora Petanidou: *Merodon rufus* group (Diptera, Syrphidae) – recent vicariance in South-East Europe

11:00 – 11:15 Antonio Ricarte, Zorica Nedeljković* & Mª Ángeles Marcos-García: A preliminary revision of the Spanish *Chrysotoxum* Meigen and *Xanthogramma* Schiner hoverflies (Diptera: Syrphidae)

11:15 – 11:30 Short break

SESSION 2. FAUNISTICS, BIOGEOGRAPHY, BIODIVERSITY ASSESSMENT AND CONSERVATION

Chairs**: Jeroen van Steenis**, **Grigory Popov**

11:30 – 11:45 Axel Ssymank*: Hoverflies (Diptera: Syrphidae) in dry subcontinental steppic grassland in Thuringia (Germany)

11:45 – 12:00 Wouter van Steenis*: The Syrphidae of the Netherlands, 10 years later

12:00 – 12:15 Leendert-Jan van der Ent*: Comparison of country specific with official IUCN Red List criteria: an example from hoverflies the Netherlands

12:15 – 12:30 Marina Janković*, Marija Miličić, Jelena Ačanski, Snežana Popov & Ante Vujić: Hoverflies of Serbia: What suits them better – Protected Areas or Prime Hoverfly Areas?

12:30 – 14:30 Lunch

14:30 – 14:45 Bärbel Koch*, Lucia Pollini Paltrinieri & Isabella Forini-Giacalone: One-year survey of the syrphid fauna in three wooded areas in the Canton of Ticino, Switzerland

14:45 – 15:00 Sander Bot*, Ximo Mengual & André Reimann: The hoverflies of Georgia

15:00 – 15:15 Valerii Mutin*: The hoverflies of Silinskii Park (Komsomolsk-na-Amure, Russia)

15:15 – 15:30 Anatolij V. Barkalov: Preliminary list of the hoverflies (Diptera, Syrphidae) of Republic of Tajikistan

15:30 – 16:00 Coffee break

16:00 – 16:15 John M. Midgley* & Kurt Jordaens: A preliminary checklist of Syrphidae from South Africa

16:15 – 16:30 Kurt Jordaens*, James Peter Egonyu, Ximo Mengual, Menno Reemer, Jeffrey H. Skevington & Gunilla Ståhls: Towards a checklist of the Syrphidae (Diptera) of Uganda

16:30 – 16:45 John T. Smit*, Theo Zeegers, Martin Hauser, Jeroen van Steenis & Phurpa Dorji: Preliminary checklist of the hoverflies of the Kingdom of Bhutan (Diptera: Syrphidae)

16:45 – 17:00 Augusto León Montoya Giraldo*: Origin, diversity and endemism of the Neotropical Syrphidae: implication for conservation of rare and threatened genera

17:00 – 17:15 Augusto León Montoya Giraldo* & F. Chris Thompson: The flower flies genus *Tuberculanostoma* Fluke as flagship entities for the conservation of Páramo ecosystems in Tropical Andes

17:15 – 18:00 Poster session 1 (posters 1–12)

TUESDAY 10TH SEPTEMBER 2019

08:30 – 09:00 Opening

SESSION 3. BIOLOGY, ECOLOGY AND INTEGRATED PEST MANAGEMENT

Chairs: **Francis Gilbert**, **Santos Rojo**

09:00 – 09:15 Marija Miličić*, Tamara Jurca, Snežana Popov, Marina Janković, Pedro Cardoso, Jelena Ačanski & Ante Vujić: Identifying hoverfly functional groups in Southeast Europe in response to different land cover types

09:15 – 09:30 Ximo Mengual*, Chong Chin Heo, Rahimi Razuin, M. Shahirul Isa, Syameem Zainal, Nabihah Khofar & Wasi Ahmad Nazni: First record of *Eristalinus arvorum* (Fabricius, 1787) in human corpse

09:30 – 09:45 Brigitte Howarth* & Roxanne Whelan: Long-term Malaise Trap Monitoring of Seasonal Variation, Species Abundance and Evenness of Syrphidae in a Hajar Mountain Wadi Ecosystem (UAE: Wadi Qinan, Ras Al Khaimah)

09:45 – 10:00 Andrea Aracil*, Jelena Ačanski, Celeste Pérez-Bañón, Marija Miličić, Andrés Campoy, Snežana Radenković, Ante Vujić, Predrag Radišić, Branko Šikoparija, Gunilla Ståhls & Santos Rojo: Biology, ecology and pre-imaginal stages morphology of the new species framed in the *Merodon planifacies* Bezzi, 1915 species complex: *M. capi* and *M. roni* (Diptera: Syrphidae)

10:00 – 10:45 Coffee break

10:45 – 11:00 Andrés Campoy*, Olga Egea-Casas, Celeste Pérez-Bañón & Santos Rojo: The effect of cold temperature on the pupal development of two pollinator species: *Eristalinus aeneus* (Scopoli, 1763) and *Eristalis tenax* (Linnaeus, 1758)

11:00 – 11:15 Mírian N. Morales*, Ana Paula Nascimento da Silva, Anna Mara F. Maciel, Carlos E. S. Bezerra, Brígida Souza, Marcel G. Hermes, Celeste Pérez-Bañón & Santos Rojo: Life history of *Allograpta exotica* (Diptera, Syrphidae) fed on *Myzus persicae* (Hemiptera: Aphididae) under laboratory conditions

11:15 – 11:30 Ximo Mengual* & Andreas Fleischmann: New biological information on *Toxomerus basalis* (Walker, 1836), the sundew flower fly

11:30 – 11:45 Gabriel J. Souba-Dols*, Antonio Ricarte & Mª Ángeles Marcos-García: Trophic regimes and biology of the *Merodon* Meigen hoverflies from a Mediterranean ecosystem in Spain

11:45 – 12:00 Short break

12:00 – 12:15 María Inés Lillo*, Celeste Pérez-Bañón & Santos Rojo: Life cycle and fertility parameters of *Eupeodes corollae* (Fabricius, 1974), fed on the aphid *Myzus persicae* (Sulzer, 1776)

12:15 – 12:30 Kevin M. Moran* & Jeffrey H. Skevington: Mimicry in the subtribe Criorhinina (Diptera: Syrphidae: Eristalinae)

12:30 – 14:30 Lunch

14:30 – 14:45 Klára Daňková*, Antonín Hlaváček, Lukáš Janošík, Jiří Hadrava & Karin Nordström: Mimicry versus thermoregulation: Experimental study

14:45 – 15:00 Lidia Sáez*, Celeste Pérez-Bañón, Ronald Driessen & Santos Rojo: Use of different species of syrphids as commercial pollinators in celery crops (*Apium graveolens* var. *rapaceum* and *Apium graveolens* var. *dulce*) under greenhouse conditions

15:00 – 15:15 Sarah Gabel*, Blanaid White & Jane Stout: The interactions of aphidophagous Syrphids in Irish cereal crop landscapes

15:15 – 15:30 Grigory Popov* & Ruslan Mishustin: The bulb hoverflies of the *Merodon constans* group inhabit in the snowdrops

15:30 – 15:45 Augusto León Montoya Giraldo* & Marta Wolff E.: Composition and phenology of flower flies (Diptera: Syrphidae) in high Andean ecosystems of north-western Colombia

15:45 – 16:15 Coffee break

16:15 – 17:00 Poster session 2 (posters 13–24)

20.00 Symposium Dinner

WEDNESDAY 11TH SEPTEMBER 2019

08:30 – 09:00 Opening

SESSION 4. PHYLOGENETICS AND DNA BARCODING

Chairs: **Gunilla Ståhls**, **Ximo Mengual**

9:00 – 9:15 Jeffrey H. Skevington*, Kevin M. Moran, Andrew D. Young, Ximo Mengual, Trevor Burt, Scott Kelso, Kurt Jordaens, Gunilla Ståhls, Sander Bot, Martin Hauser, Jeroen van Steenis, Gil Felipe Gonçalves Miranda, Marc De Meyer, Axel Ssymank, Wouter van Steenis, Menno van Zuijen, Valerii Mutin, Menno Reemer, Michelle M. Locke, Anatolij V. Barkalov, Mírian N. Morales, Ante Vujić, Chris Palmer, Katsuyoshi Ichige, Maarten de Groot & Jackson Eyres: Phylogeny of Eristalinae using target enrichment data

09:15 – 09:30 Francis Gilbert*, Alice Leavey & Tom Reader: The phylogeny of wasp mimicry in the Syrphidae

09:30 – 09:45 Gunilla Ståhls*, Ljiljana Šašić Zorić, Laura Likov, Snežana Radenković, Sander Bot & Ante Vujić: MtDNA COI barcode variability of species of subgenus *Taeniocheilosia* (Syrphidae: Cheilosia)

09:45 – 10:00 Ximo Mengual*, Guillermo P. López-García, Menno Reemer & Guillermo Debandi: New information on *Microdon bruchi* Shannon, 1927 (Diptera, Syrphidae): taxonomy, DNA barcodes, morphology of third-instar and first record in ant nests inside plants of *Vitis vinifera* L. from Argentina

10:00 – 10:15 Nevena Veličković*, Mihajla Đan, Lea Kurtek, Axel Ssymank, Snežana Radenković & Ante Vujić: Molecular characterisation of the species within the genus *Platynochaetus* Wiedemann (Diptera: Syrphidae) in the Western Mediterranean

10:15 – 11:00 Coffee break

11:00 – 11:15 Ljiljana Šašić Zorić*, Gunilla Ståhls, Mihajla Đan & Ante Vujić: Unexpectedly high COI divergence between Balkan and Anatolian lineages of *Merodon ambiguus* and *Merodon sapphous* (Diptera, Syrphidae)

11:15 – 11:30 Isabel C. Kilian Salas*, Katharina Kurzrock, Stephanie S. Swenson, Axel Ssymank, W.J. Wägele, Andrée Hamm, Ralph S. Peters, Birgit Gemeinholzer & Ximo Mengual: Assessing the role of Syrphidae as potential pollinators in agro-ecosystems via DNA-metabarcoding

11:30 – 11:45 Jiří Hadrava*, Ximo Mengual, Jeffrey H. Skevington, Kevin Moran, Scott Kelso, Claudia Etzbauer & Jan Klečka: Phylogeny of genus *Temnostoma* Le Peletier & Serville, 1828

11:45 – 12:00 Antonia Chroni*, Milomir Stefanović, Mihajla Đan, Ante Vujić, Ljiljana Šašić Zorić, Nataša Kočiš Tubić & Theodora Petanidou: A methodological framework for inferring spatial genetic patterns: the case of the genus *Eumerus* (Diptera: Syrphidae) in the Mediterranean

12:00 – 12:15 Anooj Sainulabdeen Sulaikha* & Krishna Gopinathan Kumar: Morphological and molecular analysis reveals a new Microdontinae (Diptera: Syrphidae) species from India

12:30 – 14:30 Lunch

14:30 – 15:30 Open discussion – closing remarks

15:30 – 16:30 Coffee break

16:45 IUCN Presentation

THURSDAY 12TH SEPTEMBER 2019

8.00 Excursion

LIST OF POSTER PRESENTATIONS

1. **Andrijana Andrić*, Andrea Aracil, Celeste Pérez-Bañón, Snežana Radenković, Grigory Popov, Ruslan Mishustin & Ante Vujić**
   The puzzling role of immature stages' morphology in the taxonomy of genus *Merodon* (Diptera: Syrphidae)

2. **Daniel Aznar, Celeste Pérez-Bañón* & Santos Rojo**
   Comparison of two semi-artificial rearing media on the life cycle of *Eristalis arbustorum* (Linnaeus, 1758) using Age-Stage Two Sex life table

3. **Sihem Djellab*, Nadjoua Mebarkia, Haffaressas Besma, Antonio Ricarte & Boudjemaa Samraoui**
   The Hoverflies of Algeria (Diptera: Syrphidae): Biodiversity and Conservation

4. **Ana Grković*, Marija Miličić, Jelena Ačanski, Nataša Kočiš Tubić, Marina Janković, Snežana Radenković & Ante Vujić**
   Small habitats as a source of hidden biodiversity on the example of genus *Eumerus* Meigen, 1822 (Diptera: Syrphidae)

5. **Jiří Hadrava*, Tereza Putalová, Klára Daňková, Antonín Hlaváček, Michal Tkoč & Jan Klečka**
   Distribution of hoverflies in the Czech Republic

6. **Martin Hauser***
   The genus *Eumerus* Meigen (Syrphidae) in Madagascar

7. **Antonín Hlaváček*, Klára Daňková, Lukáš Jánošík & Jiří Hadrava**
   Thermoregulation of hoverflies

8. **Kurt Jordaens*, Robert Copeland, Georg Goergen, Michelle Hamer, Steven Janssens, Ashley H. Kirk-Spriggs, John M. Midgley, Burgert Muller & Laban Njoroge**
   The Pollinator Information Network for Two-Winged Insects (PINDIP): an update

9. **Nataša Kočiš Tubić*, Ante Vujić , Laura Likov, Snežana Radenković & Mihajla Đan**
   Genetic diversity of the *Merodon serrulatus* group (Diptera, Syrphidae)

10. **Xavier Lair*, Lise Ropars, Benoit Geslin & Gabriel Nève***
    Revision of *Pelecocera* from France, including description of a new species

(Diptera : Syrphidae)

11. **Suzana Malidžan*, Ante Vujić, Snežana Radenković, Milica Ranković & Tamara Tot**
Checklist of hoverflies (Diptera: Syrphidae) of Montenegro

12. **Zlata Markov Ristić, Sonja Mudri-Stojnić, Snežana Popov* & Ante Vujić**
Species richness of hoverflies in different habitat types in Vojvodina (Serbia)

13. **Augusto León Montoya Giraldo*, Eliana Buenaventura & Marta Wolff E.**
Preliminary phylogeny of Neotropical Bacchini (Syrphidae) based on the combination of morphological and molecular data: new insight into the evolution of *Argentinomyia* Lynch and *Talahua* Fluke

14. **Augusto León Montoya Giraldo* & Gil Felipe Gonçalves Miranda**
Current status of the Red List of Neotropical Syrphidae

15. **Valerii Mutin*, Vera Skurikhina & Maxim Sergeev**
The hoverfly fauna (Diptera: Syrphidae) of the Sichote-Alin Reserve (Russia)

16. **Georgios Nakas*, Aphrodite Kantsa, Ana Grković, Ante Vujić & Theodora Petanidou**
The effect of fire on hoverfly diversity in Mediterranean communities

17. **Zorica Nedeljković*, Ljiljana Šašić Zorić, Tamara Tot, Dubravka Milić, Rüstem Hayat, Mihajla Đan & Ante Vujić**
Diversity of the genus *Chrysotoxum* Meigen, 1802 (Diptera: Syrphidae) in southeastern Europe and Turkey

18. **Snežana Popov*, Marija Miličić *, Marina Janković & Ante Vujić**
How complete are they? Comparing hoverfly diversity across different vegetation types in Southeast Europe

19. **Snežana Radenković*, Ante Vujić, Nevena Veličković, Gunilla Ståhls, Ana Grković, Mihajla Đan, Celeste Pérez-Bañón, Santos Rojo & Kurt Jordaens**
New species in the *Eumerus ornatus* group (Diptera: Syrphidae) from the Republic of South Africa

20. **Milica Ranković*, Ante Vujić, Snežana Radenković, Suzana Malidžan & Dubravka Milić**
Hoverfly (Diptera: Syrphidae) diversity in Montenegro

21. **Anja Šebić*, Maarten de Groot, Snežana Radenković & Ante Vujić**
New records to the Slovenian hoverfly fauna (Diptera: Syrphidae)

22. **Tamara Tot*, Ante Vujić, Zorica Nedeljković, Snežana Radenković & Miroslav Barták**
New *Paragus* Latreille, 1804 (Diptera, Syrphidae) species from Kazakhstan

23. **Sanja Veselić*, Gunilla Ståhls, Ante Vujić, Snežana Radenković, Laura Likov & Ljiljana Šašić Zorić**
Characterisation of *Merodon albifrons+desuturinus* lineage using total evidence approach

24. **Sergio Leonardo Ángel Villarreal, Augusto León Montoya Giraldo* & Raul Giovanni Bogotá Ángel**
Flower flies communities associated with pollen transport in three land covers of Andean forest in the Quebrada las Delicas in Bogotá, Colombia

ABSTRACTS

Abstracts, for both talks (p. 17) and posters (p. 68), are arranged in alphabetical order by first author's last name, with names of presenting authors marked with an asterisk. Most abstracts were edited to a certain extent, but the content remains the sole responsibility of the authors.

TALKS

Biology, ecology and pre-imaginal stages of new species in the *Merodon planifacies* Bezzi, 1915 species complex: *M. capi* and *M. roni* (Diptera:Syrphidae)

Andrea Aracil[1]*, Jelena Ačanski[2], Celeste Pérez-Bañón[1], Marija Miličić[2], Andrés Campoy[1], Snežana Radenković[3], Ante Vujić[3], Predrag Radišić[2,3], Branko Šikoparija[2,3], Gunilla Ståhls[4] & Santos Rojo[1]

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Keywords: ecology; geometric morphometry; *Merodon planifacies* complex; morphology; pre-imaginal stages

The genus *Merodon* Meigen, 1803 is the largest European hoverfly genus, widely distributed around the Palaearctic and Afrotropical regions. Larvae of *Merodon* are phytophagous, feeding on buried plant storage structures, often bulbs of plants pollinated by the adults. The larval morphology and habits of most species remain unknown.

Merodon planifacies Bezzi, 1915, belongs to the Afrotropical lineage of the *M. desuturinus* species-group. The latest studies of *Merodon* in Africa have revealed the existence of two new species within the taxon previously known as *Merodon planifacies,* found exclusively in the Drakensberg Mountains in Republic of South Africa, specifically in the Cathedral Peak National Park and the Royal Natal National Park. These two new species are *M. capi* in litt. and *M. roni* in litt.

The current study presents the general description of the pre-imaginal stages of *M. capi* and *M. roni*, together with the functional morphology of the cephalopharyngeal skeleton. Geometric morphometry and linear measurements were carried out on the spiracular openings of the Posterior Respiratory Process (PRP) of pupae. There were differences in the shape of the PRP and spiracular openings between the two species. The feeding

requirements of adults of the two species were analysed and compared with a third species from the *M. desuturinus* species-group, found in the same valleys at the same time: *M. drakonis* Vujić & Radenković, 2018. Pollen grains found on the body and in the gut were identified and counted; the morphology of the mouthparts of the adults was also described and compared.

Acknowledgments: This study was funded by the project of the European Union: Horizon 2020, Marie Skłodowska-Curie action, Research and Innovation Staff Exchange (RISE) Programme: FlyHigh – Insect-plant relationships: insights into biodiversity and new applications.

Preliminary list of the hoverflies (Diptera, Syrphidae) of Republic of Tajikistan

Anatolij V. Barkalov*[1]

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Keywords: Tajikistan syrphids; fauna; new species

To date, the fauna of hover flies of the Republic of Tajikistan includes 162 species belonging to three subfamilies - Eristalinae, Syrphinae and Pipizinae, containing, respectively, 91 species from 26 genera, 66 species from 15 genera and 5 species from 4 genera. Representatives of the Microdontinae subfamily were not found in the fauna under study. The undoubted leader in the number of species in the subfamily Eristalinae is the genus *Eumerus* Meigen, 1822, containing 26 species. Following the number of species in this subfamily is the genus *Cheilosia* Meigen, 1822 with 11 species. The genus *Merodon* Meigen, 1803 is currently being processed, while only 10 species are found in it, 5 of which are not identified yet. In the subfamily Syrphinae, the most species are found in the genus *Paragus* Latreille, 1804 (12 species), followed by the genus *Chrysotoxum* Meigen, 1803 (10 species) and *Eupeodes* Osten Sacken, 1877 (9 species). Among the species noted in the study area, 52, or 32.1%, are endemics of Central Asia, while 20 species or 12.3%, and have been recorded so far only from the territory of Tajikistan. Two species are described as new – *Rohdendorfia khakimovi*, in litt. and *Eumerus muratovi*, in litt.

The hoverflies of Georgia

Sander Bot*[1], Ximo Mengual[2] & André Reimann[3]

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Keywords: checklist; Georgia; Caucasus; new record; species list

Between June and July of 2018 two teams conducted field work in Georgia to collect Syrphidae. Here we report the results of these collection events. The excursions resulted in samples of 41 species not recorded before from Georgia. Furthermore, we present a provisional checklist of the Syrphidae of Georgia. The checklist is based on previously published syrphid records, which are updated and reviewed, and on the results of the two field excursions. Some 360 species of hoverflies are now known from Georgia.

The effect of cold temperature on the pupal development of two pollinator species: *Eristalinus aeneus* (Scopoli, 1763) and *Eristalis tenax* (Linnaeus, 1758)

Andrés Campoy*[1], Olga Egea-Casas[1], Celeste Pérez-Bañón[1] & Santos Rojo[1]

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Keywords: cold temperature; pupal development; dissection; Syrphidae

The importance of syrphids as pollinators is becoming increasingly evident, not only in natural environments but also in commercial crops. The main challenges in using these species as pollinators are to produce enough numbers to ensure a high pollination rate and the coordination between the massive emergence of the adults and the flowering peak of the crop. The life cycle of many insect species can be controlled by manipulating the temperature: exposing the pupal stage to cold temperatures extends the developmental time. However, each species has a different temperature tolerance. In this research we want to find out the limits of two target species, *Eristalinus aeneus* (Scopoli, 1763) and *Eristalis tenax* (Linnaeus, 1758).

Pupae of both species were exposed to 5ºC over different periods of time (5, 10, 15, 20 and 30 days) and at different moments of their development (2 days old and 6–7 days old, respectively). Additionally, their development and the effect of the cold temperature was studied by dissecting pupae of both species.

The results point out that the exact moment when the pupae are exposed to the cold temperatures has an important effect on their survival rate. The morphological study carried out dissecting the pupae after the different treatments indicate that exposing the pupae to 5ºC completely stops development. Additionally, exposing pupae to cold temperatures over a long period compromises survival and the viability of the adults, which present several anomalies in their morphology after this lapse of time.

Acknowledgements: This publication is part of a PhD project, carried out by Andrés Campoy Pomares and funded by the Spanish Ministry of Education and Vocational Training.

A methodological framework for inferring spatial genetic patterns: the case of the genus *Eumerus* (Diptera: Syrphidae) in the Mediterranean

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Keywords: *Eumerus*; hoverfly; Mediterranean; spatial genetic patterns

The Mediterranean is endowed with a great species diversity, often affiliated with evolutionary processes, landscape discontinuities, Quaternary climatic oscillations, and human presence. Here, we discuss the potential of a methodological framework to explore species genetic structure across landscape in insect groups. We have applied the suggested biogeographic framework, and explored spatial patterns of genetic diversity of nine species of the hoverfly genus *Eumerus* in the Mediterranean region (Chroni et al. 2019). More specifically, we assessed intraspecific genetic differentiation, tested for a spatially-explicit Bayesian clustering, and evaluated the inferred results based on landscape discontinuities and presence of isolation-by-distance. Overall, the spatial genetic structure analyses inferred (i) two genetic clusters ascribed to allopatric and peripatric processes, as well as to landscape discontinuities (4 species); and (ii) one genetic cluster pointing into the hypothesis of consisting of relict taxa (5 species). We have also identified genetically-diverging regions in the Mediterranean, and discussed the potential driving forces that gave rise to these spatial genetic patterns.

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References:

Chroni A, Stefanović M, Đan M, Vujić A, Šašić Zorić L, Kočiš Tubić N & Petanidou T (2019) Connecting the dots: Bridging genetic to spatial differentiation of the genus *Eumerus* (Diptera: Syrphidae) in the Mediterranean Basin and the Balkans. Journal of Zoological Systematics and Evolutionary Research (00):1–18. 10.1111/jzs.12300

Mimicry versus thermoregulation: an experimental study

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Keywords: imperfect mimicry; coloration; evolution; ecology; physiology

Thermoregulation, the optimisation of body temperature, plays an important role in the life of a hoverfly. Thermoregulation efficiency challenges foraging hoverflies, lekking males and overwintering females, and might affect an individual's chances of escaping from a predator. On top of that, selection pressure for efficient thermoregulation could affect species at an evolutionary level and is hypothesized to maintain imperfect mimicry. Imperfect mimics tend to be darker than perfect ones, and the darkness of their coloration is often dependent on the developmental temperature (thermal melanism). These properties could indicate a better ability to thermoregulate.

We set these two aims: 1) to study relationships between thermoregulation, mimicry accuracy and resemblance to the model in field conditions; 2) to study thermoregulation mechanisms in detail in a non-thermally-melanic species, *Eristalis tenax*.

In the first part of the project, we examined relative body temperature of 566 specimens in 47 species of hoverflies from 29 genera in the field, using a microprobe. Bumblebee-mimics had the highest relative body temperature, followed by honeybee-mimics, wasp-mimics and solitary bee-mimics. We did not find a significant correlation between mimicry accuracy and relative body temperature in our data.

In the second part of the project, we reared *E. tenax* in three different temperatures in the lab. We found a negative correlation between developmental temperature and ability to stay active at low temperatures. We conclude that there could be a

physiological mechanism that trades off thermal melanism with mimetic accuracy in *E. tenax*.

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The interactions of aphidophagous Syrphids in Irish cereal crop landscapes

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Keywords: *Episyrphus balteatus*; predators; hedges; pesticides; agriculture

Aphidophagous hoverflies (Syrphidae, Diptera) are considered an important asset to provide bio-control services for aphids. However, how the landscape influences their performance as effective predators is not fully understood. With a better understanding of the influences that various landscape factors have on syrphid communities, farms can be managed to optimize their pest-controlling services. This can aid in the conservation of wildlife by protecting habitats, and possibly even save farmers time and money by reducing chemical and mechanical inputs.

With a focus on Irish cereal crops, the purpose of this research (PhD project of first author) is to test how in-field characteristics might influence the diversity, health, and behaviour of aphidophagous hoverflies. The physical characteristics (i.e. hedge structure), the abundance of food resources (i.e. flowering plants and aphids), and the presence of competitors for those food resources in cereal crops were determined, with the purpose of linking them to the observed hoverfly community. The chemistry of food resources was also investigated, specifically looking for insecticide residues in flower nectar and pollen, and crop aphids. The final investigation is to measure the impacts of Thiacloprid (neonicotinoid insecticide) in nectar diets on one of the most common aphidophagous species, *Episyrphus balteatus* (L., 1758). The results will report lethal impacts as LD50s at 24, 48, and 72-hours, and sub-lethal impacts by analysing differences in activity time budgets between varied Thiacloprid doses, and over time after initial exposure. Together all these findings will contribute to strategies for conserving beneficial insects in cereal crops.

The phylogeny of wasp mimicry in the Syrphidae

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Has mimicry of social wasps evolved multiple times within the phylogeny of the Syrphidae, and if so, with what traits is it associated? We assessed the degree of wasp mimicry of a wide variety of hoverfly colour patterns using the Distance Transform technique (Taylor et al. 2013), and then matched this trait to a phylogeny of the species concerned (based on Katzourakis et al 2001 and amended by recent molecular studies). We then used phylogenetic least squares analysis to assess the extent to which the trait is influenced by phylogeny, and the effects of other traits such as larval feeding mode.

References:

Katzourakis A, Purvis A, Azmeh S, Rotheray GE & Gilbert F (2014) Macroevolution of hoverflies (Diptera: Syrphidae): an analysis of phylogeny and adult characters. Journal of Evolutionary Biology 14(2): 219–227.

Taylor CH, Gilbert F & Reader T (2013) Distance transform: a tool for the study of animal colour patterns. Methods in Ecology & Evolution 4(8):771–781.

Phylogeny of genus *Temnostoma* Le Peletier & Serville, 1828

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Keywords: *Temnostoma*; phylogeny

Temnostoma Le Peletier & Serville, 1828 is one of the most emblematic wasp-mimicking hoverfly genera, with more than 30 valid species in Holartic and Oriental Regions. Despite their appeal, phylogenetic relationships among wasp-like *Temnostoma* species and species with different coloration patterns are still unknown. In order to shed some light on this matter, we sequenced six genes (COI, 28S and four nuclear protein-coding genes) from 40 specimens including 75% of the described species of *Temnostoma* plus several outgroups, including the closely related genera *Takaomyia* Hervé-Bazin, 1914 and *Pterallastes* Loew, 1863. From this, we inferred a molecular phylogenetic tree for *Temnostoma* using Maximum Likelihood and Bayesian inference. The results strongly support the monophyly of *Temnostoma* and resolve *Takaomyia* as the sister group to *Temnostoma*. Within *Temnostoma*, three species groups were supported with a few notable exceptions: the *bombylans*-group, the *apiforme*-group, and the *vespiforme*-group. Species-level relationships were well resolved within the *bombylans*-group and *apiforme*-group; in the *vespiforme*-group the species relationships were less clear.

Long-term Malaise Trap Monitoring of Seasonal Variation, Species Abundance and Evenness of Syrphidae in a Hajar Mountain Wadi Ecosystem (UAE: Wadi Qinan, Ras Al Khaimah)

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Keywords: seasonal variation; hyper-arid ecosystem; wadi; Arabian Peninsula; long-term monitoring

Few ecological studies in the United Arab Emirates (UAE) have focused on insects, let alone hoverflies, despite serious threats caused by a rapidly developing country (e.g. habitat loss). A recent arthropod inventory project, led by van Harten, provided a platform for professional entomologists to study arthropods that occur in the semi-arid to hyper-arid ecosystems of the UAE. In volume 6, Smit et al. (2017) contribute a chapter on the hoverflies of the Arabian Peninsula with a checklist of 22 species from the UAE, one of which is new to science. The current study aims to address the shortfall of ecological studies through long-term malaise trap monitoring of species assemblages and seasonal variation of arthropod populations that occur in a natural mountain environment. The analysis of Syrphidae is a first attempt at sample interpretation.

A malaise trap set up in October 2015 continually collects till the present day in a mountain wadi (Hajar Mountains) in the Emirate of Ras Al Khaimah (Wadi Qinan, tributary to Wadi Showkha) with samples collected every two weeks. Seasonal syrphid species diversity and richness is presented. In total, 83 trap samples were examined, of which 19 (23%) contained at least one Syrphidae species, with the total count of Syrphidae being 77 individuals. Wadi Qinan's syrphid fauna represents approximately 30% of the Syrphidae recorded in the UAE. Results are compared to another location in the Hajar Mountains (Wadi Hatta, Emirate of Dubai) where a malaise trap was operated from 18 April 2017- 21 March 2018.

Acknowledgements: Zayed University for the use of the research vehicle RAK Bank for partially funding equipment

References:

Smit JT, van Harten A & Ketelaar R (2017) The hoverflies of the Arabian Peninsula. In A. van Harten, Arthropod Fauna of the UAE, Abu Dhabi (6):572–612.

Hoverflies of Serbia: What suits them better – Protected Areas or Prime Hoverfly Areas?

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Keywords: conservation; efficiency; insects; Syrphidae

Biodiversity is declining on a global level, which raises the question of efficiency of Protected Areas (PAs). Furthermore, PAs are often established for political or economic reasons, rather than based on ecological principles, or scientific criteria. When designating PAs, the focus is mainly on well known, charismatic species, often leaving invertebrates, especially insects, underrepresented.

In Serbia, 77 species of hoverflies have been protected by the national law Code on declaration and protection of strictly protected and protected wild species of plants, animals and fungi (Official Gazette of RS, no. 5/2010). In order to improve the conservation status of hoverflies, Vujić et al. (2016) identified species of conservation concern and proposed priority areas (Prime Hoverfly Areas - PHA) for their preservation in Serbia, based on long-term monitoring data.

The aims of this study are to identify the areas of high hoverfly diversity in Serbia and to evaluate the efficiency of protected areas and Prime Hoverfly Areas in conservation of hoverfly diversity, especially species of conservation concern. The results indicate that PHA network corresponds better to areas of high hoverfly diversity than the network of PAs. The correspondence is even better when it comes to areas harbouring species of conservation concern.

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References:

Vujić A, Radenković S, Nikolić T, Radišić D, Trifunov S, Andrić A, Markov Z, Jovičić S, Mudri Stojnić S, Janković M & Lugonja P (2016) Prime Hoverfly (Insecta: Diptera: Syrphidae) areas (PHA) as a conservation tool in Serbia. Biological Conservation (198):22–32.

Towards a checklist of the Syrphidae (Diptera) of Uganda

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Keywords: Afrotropics; biodiversity; conservation; hoverflies; Uganda

Uganda is situated in Central Africa and is renowned for its high biodiversity and astonishing national parks, which hold several of the largest populations of chimpanzee and mountain gorilla, amongst other animals. While the biodiversity of vertebrates of the country is relatively well known, the biodiversity of invertebrates, perhaps excluding that of butterflies and damselflies, has been poorly studied. In order to fill this knowledge gap, we started a collaboration with Makerere University (Kampala, Uganda) and collected Syrphidae in four areas in Uganda (*i.e.*, Ruwenzori National Park, Kibale Forest National Park, Bwindi Impenetrable National Park, and Mabamba Swamps) from December 1st to 18th, 2018. Adults were caught with Malaise traps and using hand nets. The Syrphidae were identified and the species list was supplemented with data from the Falke collection (1972) at the Canadian National Collections and from the British Museum of Natural History (London). All these records will help to create the first Syrphidae checklist of Uganda. All species collected during the 2018 expedition have been sequenced and DNA barcodes have been added to the reference DNA barcode database of the Afrotropical Syrphidae. An overview of the expedition and preliminary results is presented.

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A taxonomic revision of Afrotropical *Mesembrius* (Diptera, Syrphidae)

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Keywords: Afrotropics; DNA barcoding; identification; mitogenome; sexual dimorphism

The hoverfly genus *Mesembrius* Rondani, 1857, with *ca.* 58 described species, is distributed in the Afrotropical, Australasian, Oriental and southern Palaearctic Regions. The twenty-five Afrotropical species are grouped in two subgenera, *viz*. *Mesembrius s.s*. (21 species; mainland and Madagascar) and *Vadonimyia* Séguy, 1951 (four species; Madagascar only). Here, we revise the taxonomy of the Afrotropical representatives of *Mesembrius s.s*. using external morphology, male genital morphology, DNA barcoding and mitogenomes. In brief, three taxa are synonymyzed and five taxa are new species, raising the total number of Afrotropical species in this subgenus to 23. A new identification key for males and females will be presented. Phylogenetically, there are two major clades which correspond to two morphological entities. In one morphogroup, sexual dimorphism is small but males have a very specific genital morphology. In the other morphogroup, sexual dimorphism is strong but male genital morphology is more homogeneous among different species. Evolutionary scenarios for such pattern will be discussed.

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Assessing the role of Syrphidae as potential pollinators in agro-ecosystems via DNA-metabarcoding

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Keywords: agro-ecosystems; DNA-metabarcoding; German Barcode of Life; pollination networks

The role of Syrphidae as potential pollinators has been underestimated in the past. The assessment of the performance of different taxa as potential pollinators is more important than ever considering the current biodiversity decline, particularly in agro-ecosystems where pollination services need to be better understood. In this study we combine DNA-metabarcoding, a proven effective method of identification of taxa from mixed sample, and morphological methods in order to study the role of syrphid pollinators in two important crops (apple and caraway) in Germany. In the current project, hoverflies were collected using hand-netting in apple orchards and caraway fields. The pollen attached to the specimens was removed with glycerin jelly and identified both morphologically and via metabarcoding. In total, 682 syrphids (180 specimens in apple and 502 in caraway) were collected before, during and after the flowering period of the targeted crops in 2016. In apple, 23 syrphid species belonging to 11 genera were collected; 29 species belonging to 16 genera were sampled from caraway fields and prepared for further analysis. Metabarcoding and morphological identification of pollen samples are still in progress. These results will help to obtain a deeper understanding of plant-pollinator interactions of Syrphidae in agricultural landscapes and, promote the protection of previously overlooked pollinators and biodiversity in agricultural landscapes.

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One-year survey of the syrphid fauna in three wooded areas in the Canton of Ticino, Switzerland

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Keywords: habitat analysis; Malaise trap; southern Switzerland; Syrph the Net

Despite syrphid flies have been the subject of important faunistic studies in Switzerland, especially in the 1990s, the fauna of the southern area of Switzerland, the Canton of Ticino, is poorly known. Therefore, three parallel studies in wooded areas were undertaken in 2018 in order to fill this knowledge gap and evaluate the quality of habitat using the Syrph the Net methodology. Six Malaise traps were placed in each of the three study sites. At the Bolle di Magadino (Ramsar site), a wetland natural reserve on the Lake Maggiore shore, and at the Parco delle Gole della Breggia, a geological natural reserve on the extreme south of Switzerland, the syrphid fauna was monitored during 12 months. In the Locarnese area, candidate to become a national park, the sampling was carried out for 8 months, in three different valleys in oak - chestnut woodland. The sites species lists were completed with net catches and yellow pan traps surveys. A total of 141 species were recorded during the survey. The collected data were used to complete the regional species list for the Canton of Ticino as well as to evaluate the habitat's biodiversity maintenance function of the three study sites. The abundance data of syrphid fauna were also analyzed with multivariate statistics as to highlight similarities in the syrphid communities of the habitats in the three wooded areas.

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Life cycle and fertility parameters of *Eupeodes corollae* (Fabricius, 1974) fed on the aphid *Myzus persicae* (Sulzer, 1776).

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Keywords: *Eupeodes corollae*; fertility; longevity; life cycle

Eupeodes corollae (Fabricius, 1974) is a highly anthropophilic common predatory hoverfly with a wide range of prey described, mainly aphids. It is present in most of the Palaearctic and has also been recorded in the Afrotropical region and China. In Europe it is considered an excellent candidate for the biological control of numerous aphid pests.

A life-cycle study under controlled rearing conditions is a valuable tool for the mass rearing of insects for pest management purposes. Using the age-stage, two-sex life table method (two-sex MSChart program: Chi 2014), the survival rate and longevity of all the developmental stages as well as adult fertility were estimated under controlled conditions of 25°C, 50% relative humidity and 12:12 D:L. The larvae were fed with the aphid *Myzus persicae* (Sulzer, 1776). The average duration for the eggs, larvae, pupae and adults were 2, 5.85, 6.05 and 23.8 days respectively, totalling 13.65 ± 0.06 days from egg to adult emergence. The duration of the complete biological cycle was 37.45 ± 1.35 days. A higher mortality ratio was observed during the egg and pupal stages. The average female fecundity was 170 eggs/female, with a pre-oviposition period of 4.66 ± 0.44 days. The basic reproduction rate (R0) under the conditions studied was 71.28 offspring/adult. This work was financed by the scholarship program for teachers "Doctorate Abroad" of the National University of Cuyo, Mendoza, Argentina.

New biological information on *Toxomerus basalis* (Walker, 1836), the sundew flower fly

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Keywords: behavior; Brazil; larval biology; predation; Syrphidae

The Neotropical species *Toxomerus basalis* (Walker, 1836) (Diptera, Syrphidae) has been reported feeding preys collected by carnivorous plants of the genus *Drosera* L. (Fleischmann et al. 2016). Commonly known as sundews, *Drosera* species have stalked mucilaginous glands covering their leaf surfaces in order to capture insects. Larvae of *T. basalis* can take freshly caught prey from the plant and feed on them, acting as a kleptoparasite. New field observations show that flower fly females can recognize *Drosera* plants and lay eggs on non-sticky plant parts such as the lower surface of the leaf and flower stalks. Distributional records of the *Drosera* plants and the historical records of *T. basalis* prompt us to question the known dietary strategy of the flower fly.

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References:

Fleischmann A, Rivadavia F, Gonella PM, Pérez-Bañón C, Mengual X & Rojo S (2016) Where is my food? Brazilian flower fly steals prey from carnivorous sundews in a newly discovered plant-animal interaction. PLoS ONE 11(5). e0153900.

New information on *Microdon bruchi* Shannon, 1927 (Diptera, Syrphidae): taxonomy, DNA barcodes, morphology of third-instar and first record in ant nests inside plants of *Vitis vinifera* L. from Argentina

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Keywords: *Chymophila*; vineyards; ant flies; barcode; larval morphology; identification key

The hoverfly subfamily Microdontinae (Diptera, Syrphidae) comprises approximately 490 described species worldwide, the majority of which live in tropical regions (Reemer 2013). The biology of the group stands out among syrphids for the close associations which these species have with ants. The larvae are usually predators of immature stages of ants, although at least one species is known to be an ectoparasitoid (Reemer 2013; Peréz-Lachaud et al. 2014). Scarce biological information is available for the majority of species and their life cycles have not yet been studied. In this study, we give new taxonomic information about the Neotropical *Microdon (Chymophila) bruchi* Shannon, 1927 and present the first record of this species in nests of *Camponotus mus* Roger, 1863 built inside *Vitis vinifera* L. plants from Mendoza, as well as the first records from Catamarca and Entre Ríos Provinces (Argentina). New COI sequences (DNA barcodes) and the description of third-instar larva are also provided.

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References:

Pérez-Lachaud G, Jervis MA, Reemer M & Lachaud JP (2014) An unusual, but not unexpected, evolutionary step taken by syrphid flies: the first record of true primary parasitoidism of ants by Microdontinae. Biological Journal of the Linnean Society (111):462–472.

Reemer M (2013) Review and phylogenetic evaluation of associations between Microdontinae (Diptera: Syrphidae) and ants (Hymenoptera: Formicidae). Psyche (538316):1–9.

First record of *Eristalinus arvorum* (Fabricius, 1787) in human corpse

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Keywords: Eristalinae; forensic entomology; Malaysia; rat-tailed maggot; Syrphidae

A body of an unknown adult female with multiple blunt traumas was discovered in May 2017 at Bukit Beruntung, Selangor, Malaysia. The partially skeletonized human remains were found within a shallow burial ground whereas the skull was exposed and visible on the ground. During autopsy examination, nine insect larvae with a posterior elongated breathing tube were recovered from the interior of the human skull and subsequently preserved in 70% ethanol. A week after the autopsy, more larvae were collected at the burial site, and some of them were reared into adults. Adult flower flies were identified as *Eristalinus arvorum* (Fabricius, 1787) (Diptera: Syrphidae) using adult morphology. Adult specimens and larvae from the skull and from the burial site were sequenced to obtain DNA barcodes, the 5' region of the cytochrome c oxidase subunit I (COI) gene. All third-instar larvae and adults shared the same DNA barcodes and immatures from skull were identified as *Eristalinus arvorum* as well, commonly known as rat-tailed maggots. Consequently, we report the first record of the genus *Eristalinus* colonizing a human cadaver and larvae of *E. arvorum* on a human corpse for the first time, and register this necrophagous species in forensic entomology.

A preliminary checklist of Syrphidae from South Africa

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Keywords: museum records; conservation assessment; species distribution

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. This list can be enhanced by including specimen records from museums, though many identifications require confirmation. The inclusion of museum records from the KwaZulu-Natal Museum (7531 specimens, 165 species), Durban Natural Science Museum (397 specimens, 45 species), Albany Museum (915 specimens, 34 species), National Museum Bloemfontein (688 specimens, 22 species) and Iziko South African Museum (562 specimens, 60 species) increases the known species from South Africa by more than 40%. Species richness is discussed and compared to the rest of the Afrotropical region.

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References:

Barraclough DA (2010) Checklist of South African Diptera. Animal checklist website (http://biodiversityadvisor.sanbi.org/research-and-modelling/checklists-and-encyclopaedia-of-life/south-african-animal-checklist/), accessed 03 June 2019.

Identifying hoverfly functional groups in Southeast Europe in response to different land-cover types

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Keywords: conservation; clustering; functional traits; perturbations; Syrphidae

The functional group is defined as a set of species that show a similar response to the environment or similar effects on ecosystem processes. Functional classification often has two different objectives: one is to investigate the effects of species on characteristics of ecosystem (functional groups effect), and the second is to explore the type of the response to changes in the environment, such as destruction of the environment, availability of resources and climate change (functional response groups). Identification of functional response groups may help to understand and predict how certain aspects of the community and the ecosystem can be affected by environmental changes.

In this study, our aim was to divide the 564 hoverfly species recorded in Southeast Europe based on their functional traits into functional groups using cluster analysis, and to use these groups to assess how functional biodiversity of hoverflies is related to different land-cover types.

The combination of information on functional groups and land-cover stratification enables a concise, comprehensive, direct assessment of hoverfly biodiversity in relation to land cover. These types of analyses provide a better base for the formulation of conservation and biodiversity policy.

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The flower flies genus *Tuberculanostoma* Fluke as flagship entities for the conservation of Páramo ecosystems in Tropical Andes

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Keywords: highland ecosystems; flagship species; assess of conservation status; endemism; unique fauna

Above 3000 m.a.s.l., 'Páramo' ecosystems cover more than 35 000 km^2 of Tropical Andes. 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, these ecosystems face anthropogenic pressures such as deforestation by mining, wood extraction, indiscriminate application of herbicides and pesticides, and loss of biological corridors by the construction of hydroelectric and roads, putting at risk ecosystem services and the species that provided.

One emblematic group inhabiting Páramo is the genus *Tuberculanostoma* Fluke, including four recognized and seven soon to be described-species, distributed from their northernmost point at 8.8°N in Venezuela to -18.23°S on the Bolivian southern. Data of ~600 specimens shown that *Tuberculanostoma* is present in 10 Neotropical provinces: Cauca (7 spp.), Magdalena (5 spp.), Páramo (4 spp.), Puna (4 spp.), Guajira (2 spp.), Western Ecuador (1 sp.), Rondônia (1 sp.), Ucayali (1 sp.), and Yungas (1 sp.).

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 guidance of International Union for Conservation of Nature (IUCN) as a first step to develop a conservation strategy for future planning and management projects in Páramo.

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

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Keywords: restricted distribution; flagship groups; cryptic genera; biogeographical patterns; conservation status

The Neotropical region is globally recognized for its high biodiversity and endemism, including seven out the twenty-five biodiversity hotspots of the World. Unfortunately, the region faces anthropogenic pressures that put in risk the species survival as well as the maintenance of the ecosystem services they provide. In this sense, all efforts to know the biodiversity and faunal composition are a priority for the development of conservation actions. One of the emblematic Neotropical group is the family Syrphidae, which reaches the highest richness in the region, with 1560 species. In order to identify flagship groups, I analyzed the origin, diversity, and endemism patterns based on information from the *Systema Dipterorum*, data derived from literature review of Neotropical fauna, as well as field data accumulated by the author. The analysis suggests that in terms of the origin and diversity, the Neotropical fauna is composed of four 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%). I present information of cryptic genera whose species composition and distinctive biogeographic patterns will be a starting point to assess the status of conservation of the Neotropical fauna.

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Composition and phenology of flower flies (Diptera: Syrphidae) in high Andean ecosystems of north-western Colombia

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Keywords: Colombia; flower flies composition; monthly abundance; Páramo diversity; environmental variables

Colombia comprises 34 Páramo complexes (~50% of these worldwide ecosystems), covering 19 330 km^2 of the country. In Colombia, these unique ecosystems harbor high richness and vulnerability, including a high number of flower flies species. We studied the composition and phenology of Syrphidae in Andean ecosystems. Six sampling were made using Malaise traps and entomological net from december 2016 to december 2017. Three ecosystems (Páramo, forest and grassland) were sampled bi-monthly over a ten-day period. Temperature, luminosity, relative humidity and precipitation were measured to relate to abundance patterns.

We sampled 35 genera, 129 species, which 53 were identified as morphospecies (Msp) (n= 1951). Páramo had the highest diversity with 59 spp. and 38 Msp (32 genera), followed by forest with 38 spp. and 24 Msp (24 genera), and grassland with 33 spp. and 7 Msp (21 genera). *Lepidomyia* Loew, *Pseudoscaeva* Vockeroth, *Talahua* Fluke, *Trichopsomyia* Williston and *Tuberculanostoma* Fluke were exclusive to Páramo (>3000 m); *Mimocalla* Hull and *Pipunculosyrphus* Hull were exclusive to forest (2850–2950 m), while *Cacoceria* Hull and *Rhinoprosopa* Hull were to grassland (2790–2840 m).

The phenology showed two peaks in richness and abundance during the summer: February (75 spp, n= 414) and September (54 spp, n= 361), with a positive correlation with raining and temperature. Twelve species were collected in all ecosystems and sampling seasons (multivoltine), while fifteen were markedly seasonal (Uni- and bivoltine). The phenology of abundant species is discussed with respect to the importance of the studied environmental variables.

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Life history of *Allograpta exotica* (Diptera, Syrphidae) fed on *Myzus persicae* (Hemiptera: Aphididae) under laboratory conditions

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Keywords: artificial rearing; biological control; green peach aphid; life table; predaceous flower flies

In order to understand biological features, and reproductive and demographic parameters of *Allograpta exotica* fed on *Myzus persicae*, an age-stage two-sex life table was constructed. The experiment was conducted under laboratory conditions at 25 ± 3°C, 70 ± 10% relative humidity, and photophase of 14 hours. A total of 63 adults (33 males and 30 females, 1:0.9 sex ratio) were obtained from the 100 eggs evaluated. The total time for larval hatching was two days, with 72% of survival rate. The average duration of egg, larval and pupal phases were 2, 7.36 and 6 days, respectively. In total, the average time for the development of the pre-imaginal phase was 15.08 days. The average adult longevity was 30.4 ± 1.81 days, with maxima and minima of 50 and 7 days for males, and 52 and four days for females, respectively. The whole biological cycle averaged 32.83 ± 2.03 days. The average fecundity was 221.07 eggs/female. The biological parameters including fecundity data, were obtained through fitting an age-stage two-sex life table, which enabled a better understanding of the biology of *A. exotica* under laboratory conditions. The larval phase was the most critical period in the biological cycle, suggesting that for mass rearing, measures should be taken in order to reduce mortality and increase survival of this species. In future studies, it would be worth incorporating predation rates and evaluating the life cycle of the prey simultaneously.

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Mimicry in the subtribe Criorhinina (Diptera: Syrphidae: Eristalinae)

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Keywords: Criorhinina; mimicry; Syrphidae

Mimicry within Criorhinina s.str. is qualitatively examined. Members of the Criorhinina are among the largest species of Syrphidae and experience tremendous selective pressure to evolve perfect mimicry. The resulting breadth of mimicry is astounding, with species mimicking *Bombus* queens or workers, other types of bees or social wasps. The prevalence of perfect mimicry within the group is examined, with attempts made to link each mimic species to a specific model. Polymorphic mimicry, in its varied forms, and the frequency of its occurrence are discussed. Within Criorhinina, single model and multi model polymorphism, sympatric and parapatric polymorphism and sex-linked polymorphism are all present. Additionally, the evolution of mimicry within the group is examined. This is enabled by a nine gene phylogeny: including all of COI, 28S D2–3, CAD1, AATS, Period along with three new loci (for a total of ~ 8kB of data). Unlike previous hypotheses, this phylogenetic analysis reveals wasp mimicry does not have a single origin and we examine the evolution of these wasp-like characters. It also enables the construction of hypotheses to explain the other myriad forms of mimicry found within the subtribe, with proposed explanations including range, model availability, emergence times and even the overarching evolution and dispersal of the group.

The hoverflies of Silinskii Park (Komsomolsk-na-Amure, Russia)

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Keywords: hoverfly; Komsomolsk-na-Amure; fauna; type-location; nature conservation

Hoverflies have been collected in Silinskii Park almost annually since 1976. The surveyed area is less than 1.5 km^2 (about ½ of the park territory) and includes the least transformed by man primary forest ecosystem. At present 204 species of 58 genera have been collected there. The park is the type-location for *Cheilosia mutini, Platycheirus barkalovi, Epistrophe latifrons, Epistrophe olgae, Neoascia amurensis, Neoascia confusa, Parasyrphus proximus, Pipiza lesovik*, as well as *Andrena mutini*. The fauna of Silinskii Park suffers strong anthropogenic impacts. The lowering of the groundwater level is the main cause of the destruction of the ecosystem of a primary coniferous-deciduous forest. The contrast of biotopes has significantly decreased over the past two decades. On the one hand, abandoned kitchen-gardens, a tree nursery and other deforested lands are intensively overgrown with secondary forest vegetation, mainly birch forests. On the other hand, ancient forests have either been destroyed or transformed after the disappearance of coniferous and old broad-leaved trees. Most species of hoverflies are known from single specimens, and it is impossible to say something definite about the condition of their populations. Among such species, one can come across the majority of saproxylic syrphids. Common species are characterized by significant fluctuations of abundance, and the causes of which are usually unknown. Some species, abundant in the park before 1999, have not been collected after or have been recorded very rarely. Perhaps this is due to a change in the forest park ecosystem as a whole.

Hoverflies of the *Merodon constans* group inhabit snowdrop bulbs

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Key words: bulb hoverflies; *Merodon constans* group; snowdrops; *Galanthus*

The authors found that eight species of the *Merodon constans* group of bulb hoverflies distributed in the Black Sea Region (Ukraine, Georgia, Turkey) feed on the bulbs of 11 snowdrop species. Monophagy on *Galanthus* was confirmed within the species group (De Goffau, 1994; Popov & Mishustin, *in press*) for the first time.

References:

De Goffau LJW (1994) *Merodon constans* in bulbs of *Galanthus nivalis* from France. Versl. Meded. Plantenz. kund. Dienst, Annual Report Diagnostic Centre 1992 (170):63–64.

Popov G & Mishustin R (2019) The bulb hoverflies of *Merodon constans* group (Diptera: Syrphidae) really inhabit in the snowdrops. Vestnik zoologii, in press.

Merodon rufus group (Diptera, Syrphidae) – recent vicariance in South-East Europe

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Keywords: Mediterranean; speciation; COI; 28S rDNA; ENM

Climatic changes associated with Pleistocene glacial cycles had profound effects on species post-glacial distributional patterns of many taxa and, therefore, also on genetic diversification, especially in environmentally sensitive habitats as mountain regions. We used DNA sequence data of two genes (mtDNA COI and nuclear 28S rDNA) of *Merodon rufus* group (Diptera: Syrphidae) from Central and Southern Europe along with environmental niche modelling (ENM) and coalescent simulations to describe evolutionary patterns and processes of diversification of taxa previously recognized by morphological analysis. Results revealed that *M. rufus* group is composed of four well-supported lineages, three of which belong to new species from Mediterranean mountains. According to the divergence time estimation, lineage diversification most probably occurred during the Pleistocene, and by a colonization model rather than by area fragmentation of a widely distributed common ancestor. ENM results showed potential overlap of climatically suitable refugia on the Balkan Peninsula for the *M. rufus* group and the beech forest with which it is possible associated, from where further colonization to other parts of Europe might have happened during Holocene.

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A preliminary revision of the Spanish *Chrysotoxum* Meigen and *Xanthogramma* Schiner hoverflies (Diptera: Syrphidae)

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Keywords: *Chrysotoxum*; *Xanthogramma*; adult morphology; Spain; new species

The taxonomy of the genera *Chrysotoxum* Meigen, 1803 and *Xanthogramma* Schiner, 1860 (Syrphidae: Syrphinae) is under current scrutiny in Europe, including the Iberian Peninsula. According to Ricarte & Marcos-García (2017), there are 13 and 6 species of *Chrysotoxum* and *Xanthogramma* recorded in Spain, respectively. These numbers are bound to change after publications in press dealing with certain species groups (e.g. *C. vernale* species group), and an ongoing morphological revision of the material available, including the main hoverfly collections of Spain. In this study, we present the last faunistic and taxonomic updates to the Spanish fauna of *Chrysotoxum* and *Xanthogramma*. Two distinctive morphotypes within *Xanthogramma marginale* (Loew, 1854) were identified, as well as a small-sized species of *Chrysotoxum* allied apparently with *C. rossicum* Becker, 1921.

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A. Ricarte and Z. Nedeljković contributed equally to this study.

References:

Ricarte A & Marcos-García MA (2017) A checklist of the Syrphidae (Diptera) of Spain, Andorra and Gibraltar. Zootaxa 4216(5):401–440.

Use of different species of syrphids as commercial pollinators in celery crops (*Apium graveolens* var. *rapaceum* and *Apium graveolens* var. *dulce*) under greenhouse conditions

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Keywords: Syrphids; pollination; floral visits; celery; weather

In the agri-food industry cross-pollination is essential in seed production systems. However, the use of hybrid plant lines to obtain high quality seeds can lead to the development of flowers that are unattractive to colonial hymenopters as bees and bumblebees, which point to the use of alternative pollinators. The objective of this study is to evaluate the pollination efficiency of three species of hoverflies in two varieties of commercial celery crops under greenhouse conditions.

The study was carried out in 14 experimental isolation net cages (18 m^2), seven of them for each variety of celery: celeriac (*Apium graveolens* var. *rapaceum* (Mill.) P.D.Sell) and blanched celery (*Apium graveolens* var. *dulce* (Mill.) DC.). The cages contained four rows of plants, one self-compatible male line and three different female lines (non-pollen producers). We tested *Eristalinus aeneus* (Scopoli, 1763) and *Eristalis tenax* (Linnaeus, 1758) with celeriac variety and *Eristalinus aeneus* and *Myathropa florea* (Linnaeus, 1758) with blanched celery variety. The pollinating activity of the flies was measured by monitoring floral visits through two types of censuses and seed production. Two different fly densities were tested, studying the effect of different factors (day period, presence of sun and temperature). Some aspects of the floral biology of the crop were also studied, including floral phenology and nectar production.

Myathropa florea showed the highest floral visit rate, followed by *E. tenax* and finally by *E. aeneus*. The pollination activity of the species was temperature-dependent: while *E. aeneus* tolerates and prefers warm environments, *E. tenax* has higher visit rates when temperatures are lower. Generally, the highest activity was focused on the mornings, and the experimental cages with the highest density were the ones with the highest pollination activity. Although the line of male plants was preferred in most cases, the female lines also received high visitation rates in the two varieties tested.

Morphological and molecular analysis reveals a new Microdontinae (Diptera: Syrphidae) species from India

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Keywords: Microdontinae; *Metadon achterbergi;* mitochondrial cytochrome oxidase subunit I; phylogenetic analysis

Microdontinae is a rare subfamily of Syrphidae which is special due to its wide morphological variations between species and myrmecophilous behavior. There are more than 400 species recorded worldwide (Reemer & Stahls 2013) but the diversity of Microdontinae is the least studied in the Indian sub continent with only 27 species reported from the region (Ghorpadé 2014c). The present study reveals a new species of Microdontinae belonging to the genus *Metadon* Reemer collected from the Northern ridge forest in Delhi, India. Unlike other typical thorny scrub forest in the region this area possesses woody trees and ample vegetation cover. The species was close to *Metadon achterbergi* Reemer as per the keys given by Reemer and Stahls (2013) but differed in characters like length to breadth ratio of second abdominal tergite, length and shape of the scutellum, shape of the abdomen, colour of the second antennal segment and colouration of the coxae. Molecular characterization of the species with mitochondrial cytochrome oxidase subunit I (mt CO1) region was carried out and the DNA sequences were aligned with that of sequence of *M. achterbergi* Reemer using Bioedit software. Sequences compared using Clustal Omega software showed 12% difference between the two species. Phylogenetic analysis by Neighbour-joining method using Clustal Omega also supported similar results. This suspected new species of *Metadon* from a forest patch in the heart of a densely populated city points directly at the importance of the native forests even in urban settings.

Acknowledgements: Head, Division of Entomology, Indian Agricultural Research Institute, New Delhi, India; Department of Zoology, North Campus, Delhi University, Delhi, India.

References:

Ghorpadé K (2014c) An updated Check-list of the Hover-flies (Diptera: Syrphidae) recorded in the Indian sub-continent. Colemania (44):1–30.

Reemer M & Ståhls G (2013) Generic revision and species classification of the Microdontinae (Diptera: Syrphidae). ZooKeys (288):1–213. doi: 10.3897/zookeys.288.4095.

Unexpected high COI divergence between Balkan and Anatolian lineages of *Merodon ambiguus* and *Merodon sapphous* (Diptera, Syrphidae)

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Keywords: mitochondrial markers; nuclear markers; speciation

Merodon ambiguus Bradescu, 1986 and *M. sapphous* Vujić, Pérez-Bañon et Radenković, 2007 belong to the *M. bessarabicus* subgroup of the *M. aureus* species group. The *M. aureus* species group has been intensively revised during the last years. Cryptic species complexes within the group were resolved using an integrative taxonomic approach. The single information source on genetic diversity of these complexes is the mitochondrial gene for the cytochrome c oxidase subunit 1, or COI. The COI gene is widely accepted as an appropriate marker for species delimitation studies, although no universal or constant threshold value for species delimitation exists. In this study, we aimed to estimate COI sequence divergence among Balkan and Anatolian lineages of *M. ambiguus* and *M. sapphous* species in order to check for cryptic speciation. The resulting distance estimation indicates high COI divergence between Balkan and Anatolian lineages in both species. Such high COI divergence corresponds to species group divergence and might indicate the presence of cryptic species. Despite high divergence between lineages of the same species, COI divergence between Balkan lineage of *M. ambiguus* and Anatolian lineage of *M. sapphous*, as well as Balkan lineage of *M. sapphous* and Anatolian lineage of *M. ambiguus*, is unexpectedly low and correspond to intraspecies or closely related species divergence level. In order to discover the cause of this inconsistency we employ additional mitochondrial and nuclear molecular markers and evaluate their levels of variability and potential utility in species delimitation studies.

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Phylogeny of Eristalinae using target enrichment data

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Keywords: molecular phylogeny; Eristalinae; Syrphidae; NGS; target enrichment

We provide a summary of work to date on the Eristalinae phylogeny project using next generation sequencing (NGS). Up to now, we have sampled 144 ingroup taxa using a probe kit developed by the Mengual lab. The probe kit was developed specifically for use with Syrphidae and samples more than 1400 orthologous genes. Ninety-seven genera and 31 non-nominal subgenera from all currently recognized Eristaline tribes are included in the current dataset. At least 84 additional species from 18 additional genera and 20 additional non-nominal subgenera are anticipated to be added to the dataset by the time of presentation. Preliminary analyses support the long-held contention that Eristalinae is paraphyletic as currently defined and should be split up into at least five subfamilies. As found with smaller molecular datasets, Microdontinae are sister to all other syrphids. *Alipumilio* is a key taxon and may be sister to all other eristalines, syrphines and pipizines. *Cyphipelta*, *Myolepta*, *Nausigaster* and *Psilota* are problem taxa and on long branches. *Cyphipelta* is potentially the closest relative of *Sphegina* and *Neoascia*. *Nausigaster* appears to be related to the ceriodines. *Myolepta* and *Psilota* cluster together and may be sister to the large clade including Eristalini, Rhingiini, Brachyopini and Milesiini. The latter two tribes are paraphyletic as currently recognized. The talk will explore the relationships suggested through preliminary analyses and discuss gaps that still need to be filled.

Preliminary checklist of the hoverflies of the Kingdom of Bhutan (Diptera: Syrphidae)

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Keywords: Himalaya; Oriental; Palearctic; syrphid fauna

The kingdom of Bhutan is a small, landlocked country in the eastern part of the Himalayas. It is bordered by Tibet in the north, the Indian states of Sikkim in the west, Arunachal Pradesh in the east and by Assam and West Bengal in the south. The landscape ranges from lush subtropical planes in the south to the subalpine Himalayan mountains in the north, with peaks in excess of 7,000 meters. It is one of the least populated countries in the area and has a forest cover of over 70% with a notable biodiversity. This predominantly Buddhist country has remained inaccessible for a long time, and is still rather difficult to access, which means that little is known about the biodiversity of invertebrates. Recently the National Biodiversity Center, Bhutan started a cooperation with Naturalis Biodiversity Center, Netherlands and 5 other Bhutanese organizations, in the Bhutan Biodiversity Project, aiming to generate knowledge on invertebrates for the Bhutanese society. The main goal is to make a survey of several invertebrate groups and make this knowledge available through publications and especially field guides. Recently two expeditions were organized by the California Department of Food and Agriculture, in late summer 2017, and by Naturalis Biodiversity Center in early spring 2018. Altogether some 70 species were encountered, including several new to science, whereas only 5 were recorded previously.

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Trophic regimes and biology of the *Merodon* Meigen hoverflies from a Mediterranean ecosystem in Alicante province, Spain

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Keywords: Font Roja Natural Park; gut content; hilltopping; host-plant interactions; *Merodon* behaviour

The genus *Merodon* Meigen, 1803 (Diptera: Syrphidae) is distributed through the Palearctic and Afrotropical regions and more than 120 species are found in Europe and Turkey. The greatest diversity of *Merodon* occurs within the Mediterranean Basin, with high endemism levels. In Spain, 40 species of *Merodon* can be found, 12 of them living in Alicante province (SE Spain) (Ricarte & Marcos-García 2017). *Merodon* larvae are phytophagous, feeding on monocot underground organs, sometimes as noxious pests, but the early stages and host plants of most species remain unknown. Adults feed on pollen and nectar being frequent flower visitors, but detailed studies on their trophic regimes and ethology are scarce. In this work, we assess the diet and behaviour of seven species of *Merodon* from the Font Roja Natural Park, a unique and well preserved oak forest in Alicante province, and we discuss the potential host-plants of their larvae. For diet identification, we dissected adults to study ingested pollen. We also collected samples of underground structures of potential host-plants and the surrounding soil searching for immatures. New behaviour and diet records will ease our understanding of the poorly known *Merodon* biology and will help pointing towards new possible host-plants.

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References:

Ricarte A & Marcos-García MA (2017) A checklist of the Syrphidae (Diptera) of Spain, Andorra and Gibraltar. Zootaxa 4216(5):401–440.

Hoverflies (Diptera: Syrphidae) in dry subcontinental steppic grassland in Thuringia (Germany)

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Keywords: EU Habitats Directive; habitat 6240; nature conservation; steppic grasslands; hoverflies

Steppic habitats have their main distribution in SE Europe and belong to the species rich habitats in the focus of EU nature protection (EU Habitats Directive). In Germany they are extremely rare with an azonal scattered distriubtion in dry regions. Typical species of EU listed habitats form an integral part of qualitative conservation status assessment, so far mainly based on plants. In Thuringia, we conducted a survey of four different steppic meadow relict siteswith Malaise traps, as a follow up of an EU-Life project of management and restoration of steppic habitats. Based on a total catch of 5003 adult specimens, 126 hoverfly species could be found and typical species for the EU habitat type 6240 could be identified. As expected there is a substantial overlap in hoverfly species composition with other dry calcareous grasslands of the Festuco-Brometea. While the Kyffhäuser is the largest area with rare species such as *Eumerus longicornis* Loew, 1855, all four sites had their specific species combinations. Therefore nature conservation must aim at conserving all existing sites, as these may represent core areas for expanding dry grassland patches due to climate warming.

References:

Ssymank A & Wolff D (2019) Schwebfliegen und Raubfliegen (Diptera: Syrphidae und Asilidae) der Thüringer Steppenrasen - ein Beitrag zur Charakterisierung des prioritären FFH-Lebensraumtyps 6240. Mauritiana 35 (2018):34–71.

MtDNA COI barcode variability of species of subgenus *Taeniocheilosia* (Syrphidae: *Cheilosia*)

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Keywords: mtDNA COI; *Taeniocheilosia*; *Cheilosia*

MtDNA COI barcodes were generated for about 90 specimens of genus *Cheilosia* subgenus *Taeniocheilosia* obtained during recent fieldwork in Central Europe, Finland, Balkan region and Asia Minor. The dataset comprised more than 20 presently recognized species. The sequences were clustered using Neighbor-Joining under the K2P model, using *Cheilosia albipila* (*Cheilosia* s.str.) as root. The majority of the *Taeniocheilosia* species were resolved as discrete sequence clusters (clades), with interspecific divergences greater than intraspecific. Several morphologically close species, however, show very low interspecific divergences (<1%). A few cases of unexpectedly high divergences were also evident which could indicate presence of morphologically cryptic species.

Comparison of country specific with official IUCN red list criteria: the example of hoverflies in the Netherlands

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Keywords: IUCN; Netherlands; Red list criteria; syrphids

In the monograph of Dutch hoverflies (Reemer et al., 2009) a specific method was used to determine whether a species was considered to be threatened. This method uses a combination of a) a limitation in number of observed 5x5 km squares and b) an estimated rate of decline. In total, 22 species were classified as severely threatened, 31 species as threatened, 21 species as vulnerable and 16 species as sensitive. The thresholds of these classes, including some adjustments, will be briefly discussed. But what would have been the red list of Dutch hoverflies if IUCN criteria had been used instead? After applying the IUCN red list criteria to all Dutch hoverfly species, a comparison will be made between both red listing methods. What does this implicate for the use of IUCN criteria on a country scale?

References

Reemer M, Renema W, van Steenis W, Zeegers Th, Barendregt A, JT Smit, van Veen MP, van Steenis J, van der Leij LJJM (2009) De Nederlandse zweefvliegen (Diptera: Syrphidae). Nederlandse Fauna (8):1–442. Leiden. Naturalis, KNNV Uitgeverij, EIS-Nederland.

http://cmsdocs.s3.amazonaws.com/RedListGuidelines.pdf

The Syrphidae of the Netherlands, 10 years later

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Ten years ago, we published our book on the Dutch Hoverflies (Reemer et al. 2009). After ten years, actually 13 years as the dataset we used was closed in 2007, it is a good moment to see what happened with the hoverfly populations in the Netherlands. More than 10 species were recorded for the first time in the Netherlands in the period, partly because of really new records, but also due to recent knowledge on cryptic diversity and changed taxonomic status. Some species showed a remarkable recovery, like *Rhingia rostrata* (Linnaeus, 1758). On the other hand, several species like *Leucozona glaucia* (Linnaeus, 1758) most probably disappeared in the Netherlands. And what about the general decrease in insect numbers? Could we come to conclusions based on the database of the Dutch hoverflies, one of the more extensive databases of Syrphidae in the world?

References:

Reemer M, Renema W, Van Steenis W, Zeegers Th, Barendregt A, Smit JT, Van Veen MP, Van Steenis J & Van der Leij LJJM (2009) De Nederlandse zweefvliegen (Diptera: Syrphidae). Nederlandse Fauna, (8):1–442. Leiden. Naturalis, KNNV Uitgeverij, EIS-Nederland.

Molecular characterization of the species within the genus *Platynochaetus* Wiedemann (Diptera: Syrphidae) in the Western Mediterranea

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Keywords: DNA barcoding; integrative taxonomy; *Platynochaetus*

The genus *Platynochaetus* Wiedemann, 1830 (Diptera: Syrphidae) is one of the 188 genera of the family Syrphidae (Thompson & Rotheray 1998) and represents one of the least studied groups of hoverflies in Europe. Three species from Western Mediterranean are known in this genus (Speight 2018). Lack of recent data and the presence of ambiguities and inconsistencies in species names make it intriguing for research. So far, the determination of the species of the genus *Platynochaetus* was based solely on morphology, and the absence of more detailed information, emphasize the necessity of continuing the study of this group, whereby due to the small number of studies conducted and the inadequacy of morphological keys, their identification is problematic. The main aim of this study was molecular characterization of the species within the genus *Platynochaetus* collected in the Western Mediterranean. A total of 33 adults were collected from Spain, Morocco, Algeria, Sicily and Malta. Both, 5' and 3' regions of the of mtDNA cytochrome c oxidase I (COI) gene were examined. The Maximum Parsimony tree pointed to the existence of three separate species, as three genetic clusters were revealed. Samples collected in Spain and Morocco belong to species *P. setosus* (Fabricius, 1794), while specimens from Sicily and Malta represent one genetic cluster corresponding to *P. macquarti* Loew, 1862. Additionally, according to molecular data one analyzed specimen from Algeria formed separate branch on the tree. Based on morphology and distribution this specimen corresponds to *P. rufus* (Macquart, 1835).

References:

Thompson FC & Rotheray G (1998) Family Syrphidae. In L Papp & B Darvas (Eds) Contributions to a Manual of Palaearctic Diptera. Higher Brachycera (pp. 81–139). Budapest: Science Herald.

Speight MCD (2018) Species accounts of European Syrphidae, 2018. Syrph the Net, the database of European Syrphidae (Diptera), vol. 103, 302 pp., Syrph the Net publications, Dublin.

The future of integrative taxonomy in hoverflies

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Keywords: *Merodon*; *Cheilosia*; morphometry; COI; 28S rRNA

Integrative taxonomy is a multisource approach that takes advantage of complementarities among disciplines and tends to make progress in species delimitation and diagnosis of cryptic diversity. Single-method approaches in taxonomic and systematic studies have many limitations, especially for diagnosis of cryptic species that can be overlooked. Cryptic species are morphologically indistinguishable (or almost), so a combination of molecular, ecological and subtle morphological characters, as well as phylogeographic and population genetic analyses have been proposed as a framework to diagnose and distinguish cryptic species.

Our overview had three objectives: (1) to present potential limitations of recently used concept of integrative taxonomy in genera *Merodon* and *Cheilosia*; (2) to discuss further methods which can be applied to clarify the species borders in these two genera, beside morphology, geometric morphometrics of wings and male surstylus shape, and molecular data; (3) to underline potential taxa where integration of all available data can help to discover cryptic diversity.

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POSTERS

The puzzling role of immature-stage morphology in the taxonomy of *Merodon* (Diptera: Syrphidae)

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Keywords: hoverfly; larva; puparium; morphology; taxonomy

The genus *Merodon* Meigen (Diptera: Syrphidae) is distributed throughout the Palaearctic and Ethiopian regions, and is characterized by a large number of species groups comprising taxa with subtle morphological differences. The taxonomic status and identification of many species still requires clarification. The adults of *Merodon* species are well studied, especially since various recent publications successfully used an integrative taxonomic approach, combining morphological and molecular information. The immature stages of this phytophagous genus, however, remain understudied, with the descriptions of larvae and/or puparia published for roughly just 5% of species. Considering both published and new data, this study aims to review and to re-evaluate the main diagnostic morphological characters of the preimaginal stages and to assess the importance of these traits as taxonomic tools for delimitation within the genus. Features distinctive among different species are mostly associated with the posterior respiratory process, pupal spiracles and cephalopharyngeal skeleton. Potentially diagnostic features are recognized for four well-supported lineages (putative subgenera) within the genus *Merodon* (*avidus-nigritarsis*, *albifrons+desuturinus*, *aureus* and *natans*) defined by adult morphological and molecular characters; however, no clear pattern is achieved for all studied taxa at this level. Furthermore, certain characters previously considered as species-specific turned out to be rather ambiguous. This study confirms the need for both more species and more specimens of *Merodon* immature stages to be examined and compared in order to obtain better supported conclusions.

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Comparison of two semi-artificial rearing media on the life cycle of *Eristalis arbustorum* (Linnaeus, 1758) using Age-Stage Two-Sex life table

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Keywords: *Eristalis arbustorum*; two sex life table; artificial rearing; life cycle

Eristalines (Syrphidae, Eristalini) play an important ecological role as pollinators. Their use in commercial crops needs efficient artificial rearing protocols to obtain mass production under controlled conditions. *Eristalis arbustorum* (Linnaeus, 1758) is a potential new target species that could be used with this objective in different agroecosystems.

The biological cycle of *E. arbustorum* is analysed, comparing two different media for larval rearing: wet decaying cereals and wet decaying cereals fortified with an organic supplement. The results were analysed using the age-stage, two-sex life table method (two-sex MSChart program), and the survival rate and longevity of all the development stages as well as adult fertility were estimated for each medium. The survival rate was clearly higher with the fortified larval medium, and the larval development time was shorter. The fecundity of the females was similar in both cases at 348 and 326 eggs per female, respectively. The intrinsic rate of increase and mean generation time were 0.0728 and 49 days for the cereal medium and 0.0976 and 40 days for the fortified cereal medium.

The Hoverflies of Algeria (Diptera: Syrphidae): Biodiversity and Conservation

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Keywords: Algeria; North African; Numidia; species diversity; syrphidae

Algeria, in the Mediterranean Basin, is the largest African country. With a high environmental diversity consisting of a plain-rich coastal zone, mountains, high steppe plains, sandy formations (dunes and ergs), and Saharan plateaus, Algeria has a poorly known hoverfly fauna limiting the use of these Diptera as bioindicators in this region. In this study, we update our knowledge on the biodiversity and conservation of the Algerian hoverflies by compiling all published information and adding new data originating from recent fieldwork in North-East Algeria (Numidia, Guelma, and Tebessa). A preliminary list of 124 species of 43 genera is provided. A total of 73, 31, and 37 species were collected in Numidia, Guelma and Tebessa regions, respectively. Species with saproxylic larvae (tree-dependent) such as those of *Brachypalpus* Macquart, 1834 and *Spilomyia* Meigen, 1803 are present in the list (Numidia), as well as species with phytophagous (e.g. *Merodon calcaratus* (Fabricius, 1794) in Guelma and *Eumerus etnensis* Goot, 1964 in Tebessa), predatory (e.g. *Eupeodes nuba* (Wiedemann, 1830) and *Paragus vandergooti* Marcos-García, 1986 in Tebessa) and saprophagous (aquatic) larvae (e.g. *Eristalinus taeniops* (Wiedemann, 1818) and *Eristalis arbustorum* (Linnaeus, 1758) in Guelma). Given the size of Algeria and its variety of habitats, the presented list is bound to increase upon further hoverfly surveys in poorly-studied or unexplored regions of Algeria.

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Small habitats as a source of hidden biodiversity on the example of genus *Eumerus* Meigen, 1822 (Diptera: Syrphidae)

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Keywords: COI gene; distribution; diversity; *Eumerus nigrorufus* sp.n.; small habitat patches

Eumerus Meigen (Diptera: Syrphidae) as one of the most speciose hoverfly genera in Europe is found to be a significant part of hoverfly fauna on Durmitor mountain (Montenegro). We found that majority of species registered on this mountain is concentrated in small species-rich habitat patches. One of these localities, Komarnica - Pošćensko Lake, stands out as particularly rich, comprising 9 out of 14 recorded *Eumerus* species on Durmitor mountain (*E. amoenus* Loew, 1848, *E. consimilis* Šimić & Vujić, 1996 and *E. montanum* Grković, Radenković & Vujić, 2017 from *strigatus* group, *E. argyropus* Loew, 1848 from *ornatus* group, *E. montenegrinus*, Grković & Vujić in litt, and *E. sulcitibius* Rondani, 1868 from *barbarus* group, *E. grandis* Meigen, 1822 and *E. nigrorufus*, Grković & Vujić, in litt, from *tricolor* group and *E. hungaricus* Szilády, 1940, which has not been assigned to any group yet). This locality also represents the type locality for recently described *Eumerus montanum* Grković, Radenković et Vujić, 2017 and two undescribed new species (*E. montenegrinus*, in litt. and *E. nigrorufus*, in litt).

Eumerus montenegrinus, in litt. belongs to *barbarus* group which in addition consists of four other Mediterranean species. This species, possibly very vulnerable because of its restricted range, is recorded with one single male specimen, despite of regular sampling.

Eumerus nigrorufus, in litt. is a representative of *tricolor* group, the largest European *Eumerus* species group and besides being found on Durmitor mountain, it is recorded on two other localities in Greece (Corfu, Peloponnese).

Although the Durmitor mountain is protected as National Park and the UNESCO World Heritage Site, we consider it is essential not to change the type of land use of small and particularly important ecosystems in order to preserve its fragile diversity.

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Distribution of hoverflies in the Czech Republic

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Keywords: Czech Republic; distribution; Syrphidae

In the Czech Republic, 401 species of hoverflies (Diptera: Syrphidae) are listed in the national check-list (Mazánek 2009). Since that time, some more species were recorded for the first time in the Czech Republic (e.g. *Xanthogramma stackelbergi* Violovitsh, 1975, *Myolepta potens* (Harris, 1776) and *Callicera rufa* Schummel, 1842). Due to the lack of data, the national red-list is not actualised. In order to get more information on the distribution and temporal changes in populations of hoverfly species, we started to create a database of hoverflies in museums and private collections. Moreover, detailed systematic monitoring of hoverflies is examined in several regions of the Czech Republic (e.g. individual collecting is used for a monitoring of hoverflies in the protected areas of the Prague city; study of phenology and migration of hoverflies in Jeseníky mountain is examined using Malaise traps). In the case of taxonomicaly problematic groups, barcoding approach will be used. On the poster, preliminary results are presented.

References:

Mazánek L (2009) Syrphidae Latreille, 1802. In: Jedlička L., Stloukalová V. & Kúdela M. (eds): Checklist of Diptera of the Czech Republic and Slovakia. Electronic version 2. http://www.edvis.sk/diptera2009/families/syrphidae.htm

The species groups of the genus *Eumerus* Meigen (Syrphidae) in Madagascar

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Keywords: Afrotropical Region; *Eumerus*; Madagascar

The genus *Eumerus* Meigen, 1822 is widespread in the Old World, with nearly 300 valid species of which more than 70 occur in the continental Afrotropics. From the Island of Madagascar, there are 10 described endemic species and an additional five introduced species. In his unpublished research on *Eumerus* of the Afrotropical Region, Leif Lyneborg recognized 12 additional species. In the extensive material of *Eumerus* housed in the California Academy of Sciences (U.S.A) from Madagascar, an additional four undescribed species are found. Most species can be divided into four groups: *obliquus* group, *ornatus* group, *macropygus* group, *rufipes* group, except the endemic *E. malagasius* Keiser, 1971, which could be in a group by itself. The preliminary results on the *Eumerus* taxonomy and fauna of Madagascar are presented in this poster.

Acknowledgements: This work is based on the work of the late Leif Lyneborg, who produced an unpublished revision of the Afrotropical *Eumerus*. I also want to thank M. Irwin, B. Fisher, F. Parker, E. Schlinger and H. (Rin'ha) Rasolondalao for collecting specimens in Madagascar, F.C. Thompson for facilitating the pinning of the material and R. Zuparko for labeling thousands of specimens.

References:

Keiser F (1971) Syrphidae von Madagaskar (Dipt.). Verhandlungen der Naturforschenden Gesellschaft zu Basel 81:223–318.

Thermoregulation of hoverflies

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Keywords: Syrphidae; ecology; physiology; sexual selection; mimicry

Thermoregulation is a physiological adaptation of an organism to its natural habitat, and then they are continuously affected by this process. The study of thermoregulatory mechanisms in hoverflies (Diptera: Syrphidae), can be interesting because can be influenced by their mimicry and ecological adaptations. We examined hoverflies in two ways:

a. Lab work with dead specimens to describe the mechanism of heating-up and cooling-down, affected by morphological traits.

b. Field research to describe active heating-up mechanisms, flight temperatures and the effect of ambient temperature on hoverflies.

In laboratory experiments, the weight of the specimen and hairiness were the key factors affecting the heating of the dead specimens. Based on 565 specimens measured in the field, we are able to describe the mechanism of heating up in hoverflies. We found out that the body temperature is mostly affected by sunlight and microhabitat temperature, although specimens were able to maintain their temperature on average of 6°C above the ambient temperature. We also dealt with thermoregulation in context with ecology and evolution of this group of insects.

The Pollinator Information Network for Two-Winged Insects (PINDIP): an update

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Keywords: Afrotropics; collections; digitization; plant-pollinator networks; training

The “Pollinator Information Network for Two-Winged Insects” (PINDIP) (2017–2019) addresses the role of Diptera (including Syrphidae) in plant-pollination systems in the Afrotropical Region and is funded by the JRS Biodiversity Foundation. It does so by creating a network for Diptera taxonomists and plant-insect interaction ecologists. Here, we give a short overview of the major achievements of the project so far which comprise: 1) the digitization of approximately 40,000 Afrotropical dipteran specimens from various families (mainly Syrphidae, Rhiniidae, Tabanidae, Calliphoridae, Nemestrinidae, and Bombyliidae), 2) the collection and digitization of several thousand additional specimens during field trips in Benin, Ghana, Togo, Uganda, Kenya, and South Africa, 3) the training of four technicians and 14 young and emerging entomologists from Africa in general entomology and collection management, 4) the construction of a website (www.pindip.org), and 5) the distribution of a Newsletter. The project aims to

create awareness of the role of, and appreciation of, Diptera in plant-pollinator networks and to build a sustainable network of trained taxonomists on Afrotropical Diptera within the Afrotropics.

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Genetic diversity of the *Merodon serrulatus* group (Diptera, Syrphidae)

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Keywords: COI gene; 28S rRNA gene; phylogenetics; hoverfly

The *Merodon serrulatus* group is one out of ten *M. avidus-nigritarsis* lineage groups. Being distributed from the Iberian Peninsula in the south-west, along the Mediterranean and Balkan Peninsula to Turkey in the southeast, and to Siberia in the northeast, *M. serrulatus* represents the species of the genus *Merodon* with the largest distributional range. A recent publication revealed that this group contains five already known species, while an ongoing revision of the *M. serrulatus* group of species based on the morphological characters and supported by molecular data of available taxa provide descriptions of seven new species (Vujić et al., in prep.).

In order to confirm the systematic position of the *M. serrulatus* group within the lineage and to establish composition of the group, we conducted the molecular analysis of mitochondrial COI and nuclear 28S rRNA gene sequences. Maximum parsimony and maximum likelihood analyses revealed the group as monophyletic. Within the group, *M. nigrocapillatus* in litt., *M. medium* in litt., *M. trizonus* Szilady, *M. bequaerti* Hurkmans and *M. sacki* Paramonov species were clearly separated to each other, while *M. defectus* in litt., although morphologically differentiated, clustered together with *M. serrulatus* Wiedemann in Meigen and *M. opacus* in litt. Moreover, a high level of interpopulation variability within *M. serrulatus* species was detected.

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Revision of *Pelecocera* from France, including description of a new species (Diptera : Syrphidae)

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Keywords: *Pelecocera*; *Chamaesyrphus*; key; France; new species

A revision of French *Pelecocera* data is presented, including both *Pelecocera* and *Chamaesyrphus* subgenera. Distribution and ecological data of all species are summarised. A new species from Mediterranean limestone scrubland is described. An identification key is given for these species.

Checklist of hoverflies (Diptera: Syrphidae) of Montenegro

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Keywords: syrphids; fauna; Montenegro; new records

Montenegro is a Mediterranean country, with highly diverse ecosystems and rich flora and fauna. It´s territory can be divided into two main biogeographical regions: Mediterranean and Alpine. The hoverfly fauna of some regions is well studied, like Mountain Durmitor and Boka Bay, while data for the central parts are scarce and sporadic. Here we present the first checklist of hoverflies in Montenegro based on data extracted from 53 articles, two monographs (Šimić 1987; Vujić 1996), collections deposited at Department of Biology and Ecology, University of Novi Sad (Serbia) and in the Natural History Museum of Montenegro, supplemented by new records from past 20 years of fieldwork. A total of 370 species from 79 genera are reported. Moreover, 69 species are recorded for the first time in Montenegro, and two of them are first records for the Balkan Peninsula: *Brachyopa obscura* Thompson et Torp, 1982 and *Platycheirus fasciculatus* Loew, 1856. In addition one species with unclear nomenclatural status closely related to *Cheilosia morio* (Zetterstedt, 1838), has been detected. Also, taxonomic status of some species within complexes of the genus *Merodon* (Vujić, in prep.) has been discussed. The list, which provides a synthesis of the regional taxonomical and faunistic work carried out until now, can serve as a baseline survey for future studies.

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References:

Šimić S (1987) Syrphidae (Insecta, Diptera). Biogeografska i ekološka analiza faune osolikih muva Durmitora sa osvrtom na faunu osolikih muva Crne Gore. – in: Fauna Durmitora, sv. 2, CANU, Pos. izd. knj. 21, Odjelj. prir. nauka, knj. 13:11–154, Titograd.

Vujić A (1996) Genus *Cheilosia* Meigen and related genera (Diptera: Syrphidae) on the Balkan Peninsula. Mon. Dep. Nat. Sci., Matica srpska, 194pp. Novi Sad.

Species richness of hoverflies in different habitat types in Vojvodina (Serbia)

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Keywords: conservation; diversity; insects; land cover; Syrphidae

Pollination is an outstanding ecosystem service, essential for plants reproduction, maintenance of biological diversity, as well as food production. Insects and other animals pollinate most of the flowering plants (87.5%). Flies (Diptera) are one of the main groups of flowers visitors, being the Syrphidae, the most essential pollinators. In Europe about 900 species were recorded (more than 400 in Serbia).

Because of this, insect pollinators over the last two decades are in the focus of fundamental and applied research. Likewise, in order to improve understanding of pollination, as well as for the maintenance and improvement of this ecosystem service, scientists in Serbia are working intensively on the hoverfly research.

It is well known that hoverflies require specific environmental conditions in order to survive in ecosystems and to conduct the pollinating services. One of the most important factors is the presence of the appropriate habitat type. The objective of this study is to assess and compare hoverfly species richness across different CORINE land cover classes in Autonomous Province of Vojvodina: Broad-leaved forest, Natural grasslands, Land principally occupied by agriculture, with significant areas of natural vegetation and Non-irrigated arable land.

As result of the study a total of 84 hoverfly species were recorded in the sample. The highest species richness was found in the broad-leaved forest (64 species), while the second place belongs to grasslands with 43 found species. As expected, the lowest species richness was found in a semi-natural and agricultural area, with 8 and 3 hoverfly species, respectively.

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Preliminary phylogeny of Neotropical Bacchini (Syrphidae) based on the combination of morphological and molecular data: new insight into the evolution of *Argentinomyia* Lynch and *Talahua* Fluke

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Keywords: phylogenetic analysis; Neotropical Bacchini; insect systematics; molecular markers

Recent molecular analyses revealed the relationships of Syrphinae, but the affinities within some genera remains an unresolved issue. The tribe Bacchini comprises 7 Neotropical genera (83 species), of which *Argentinomyia* includes 32 species and several undescribed whose relationships are unknown. The monotypic genus *Talahua* has been considered closely related to *Xanthandrus* and/or *Argentinomyia*, but its taxonomic status remains unclear. According to Thompson the distinctions between *Talahua* and *Argentinomyia* are not well understood, in consequence *Talahua* could be treated as part of *Argentinomyia*. The discovery of new *Argentinomyia* species similar in appearance to *Talahua* (differing only in the male genitalia) highlight the need of clarify its phylogenetic affinities.

We propose a new phylogeny based an extensive sampling of new and previously published sequences of genes COI, 28S and 18S, as well as morphological characters for 28 ingroup and 14 outgroup taxa, with the inclusion of previously untreated species. The data set was analyzed under maximum likelihood and Bayesian analysis. The obtained trees from molecular data were compared with the morphological topology and both datasets combined. In each analysis, we test the congruence among morphological and molecular data to support monophyletic lineages.

The monophyly of *Talahua* was supported, and the morphological characters shared with *Xanthandrus* and the new *Argentinomyia* species suggested convergence among both lineages. Our analysis recovered four to five highly supported clades of *Argentinomyia*, with several morphological characters with evolutive value. The evolution and adaptive significance of these characters are discussed and analyzed in a phylogenetic context.

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Current status of the Red List of Neotropical Syrphidae

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Keywords: highland ecosystems; flagship species; Amazonian region; tropical Andes; endemism

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 the 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 on the 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 in 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, 1535 species. In a first approach, and given that we have studied the fauna of particular flagship groups, we compiled distributional information for 10 genera and 96 species. This is a first step to assess species distribution, rarity and threats, following the guidance of International Union for Conservation of Nature (IUCN), for the 2017-2020 IUCN quadrennium of the Hoverfly Specialist Group.

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The hoverfly fauna (Diptera: Syrphidae) of the Sichote-Alin Reserve (Russia)

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Keywords: hoverflies; Sichote-Alin; fauna; biosphere reserve; nature conservation

The Sichote-Alin Biosphere Reserve (Russian Far East) reflects brightly nature features of the Central Sikhote-Alin. Its flora and fauna has attracted researchers for many decades. Little was known on the hover flies of the reserve before our field works in 1982. Later *Brachyopa primorica, Brachyopa violovitshi, Chalcosyrphus admirabilis, Cheilosia richterae, Cheilosia polja, Cheilosia parafasciata, Melanostoma boreomontanum, Neocnemodon tsherepanovi, Pipiza aurea, Pipiza mutini, Pipiza nielseni, Sphegina carbonaria, Sphegina tenuifemorata, Sphegina verae, Xylota sichotana* were described based on the collected material. As to other information on syrphids it has been published as well (Mutin, 2012, 2017). The syrphid collections made in the reserve in recent years allow the compilation of a fauna list. At present 258 species of 68 genera have been collected. The reserve is the most northern location recorded for *Graptomyza subflavonotata, Ferdinandea luteola, Neocnemodon simplicipes*. The coniferous-deciduous forests of the Eastern macroslope Sikhote-Alin are the most fully investigated,with 234 species found there. Most of them were recorded near the Tikhaya Cordon, where our stationary studies were conducted in 1982. The vast territory of the reserve, which belongs to the Columbus River Basin (western macroslope of Sikhote-Alin), is the least surveyed one, and only 67 species have been found there. Some of them (*Eristalis cryptarum, Sericomyia jakutica, Chalcosyrphus carbonus, Pseudopocota stackelbergi*) have not been found in other places of the reserve yet. The coastal part of the reserve, occupied by oak forests and meadows, has long been subject to human influence, a total of 82 species are known from here. *Sphaerophoria scripta* is found only here, within the reserve.

References:

Mutin VA (2012) Biogeographic aspects of the hover-fly fauna (Diptera, Syrphidae) of the Sikhote-Alin Mountains. In: *A.I. Kurentsov's Annual Memorial Meetings. Issue 23.* Dalnauka, Vladivostok. P. 47–64. [In Russian with English summary].

Mutin VA (2017) Foraging of hoverflies (Diptera, Syrphidae) by pollen of anemophilous plants. In: *A.I. Kurentsov's Annual Memorial Meetings. Issue 28.* Dalnauka, Vladivostok. P. 87–94. [In Russian with English summary].

The effect of fire on hoverfly diversity in Mediterranean communities

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Keywords: Syrphidae; pollination; wildfires; Mediterranean ecosystems

Wildfires affect pollinators in several ways. Several studies have investigated wildfire effects on species abundance, diversity and functional traits of several pollinator groups, whereas there is little evidence regarding hoverflies. In this study we explore the effects of fire on the diversity and functional traits of hoverflies in 13 Mediterranean communities on Chios Island, Greece. In each site, data were collected using pantraps and hand-net in nine burnt and four unburnt sites during three rounds per year and over three consecutive years following the summer 2012 fire. A total of 960 specimens (50 species) were collected which were analysed employing a combined approach of generalized linear models.

Our results show that fire affects significantly hoverfly diversity and functional traits. In particular, the 1st post-fire year communities differ from those of the 2nd and of the 3rd post-fire years, as well as from the unburnt communities. The 1st post-fire year communities were more homogenized, had higher diversity, and contained more migratory species compared to unburnt sites. Species distinguishing between burnt and unburnt sites were: the migratory *Eristalis tenax* (L., 1758), *Eupeodes corollae* (Fabricius, 1794) and *Scaeva pyrastri* (L., 1758), which were more abundant in the 1st post-fire year; and the non-migratory *Merodon velox* Loew, 1869, which was more abundant in the unburnt sites. The differences among burnt and unburnt sites were less pronounced during the 2nd post-fire year and disappear on the 3rd one.

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Diversity of the genus *Chrysotoxum* Meigen, 1802 (Diptera: Syrphidae) in southeastern Europe and Turkey

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Keywords: *Chrysotoxum*; new species; new record

The genus *Chrysotoxum* (Syrphinae: Syrphini) consists of large, wasp-mimicking species with elongated antennae, an abdomen strongly convex dorsally, with yellow fasciae on terga, and the thoracic pleurae with yellow maculae (Thompson & Rotheray 1998). *Chrysotoxum* species are distributed in all biogeographical regions except Australasia and Antarctica (Vockeroth 1969; Thompson, Rotheray & Zumbado 2010). In the Palaearctic, 71 species have been recorded, 21 of which are present in Europe plus Turkey (Speight 2018).

Although comprehensive studies of the species of the *C. festivum* and *C. vernale* groups were conducted for the Balkan Peninsula (Nedeljković et al. 2013; 2015), that of the *C. intermedium* is still under scrutiny. As a result of comprehensive faunistic and taxonomic study four new species were described from Turkey in the last two years (Vujić et al. 2017; Nedeljković et al. 2018).

Examination of about 2000 specimens of *Chrysotoxum* from different localities in southeastern Europe and Turkey resulted in the identification of 26 species, one of which is new to science and other three are morphologically distinctive morphotypes and, possibly new species. *Chrysotoxum verae* Violovitsh, 1973, an extremely rare species, known only from the type locality (Caucasus, Armenia), is new for the Turkish fauna. Relationships among the 9 studied species were analyzed and discussed based on the data of nuclear (ITS2) and mitochondrial (COI) genes sequences. Distribution maps for each species are provided.

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References:

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

Nedeljković Z, Ačanski J, Đan M, Obreht-Vidaković D, Ricarte A & Vujić A (2015) An integrated approach to delimiting species borders in the genus *Chrysotoxum* Meigen, 1803 (Diptera: Syrphidae), with description of two new species. Contributions to Zoology, 84:285–304.

Nedeljković Z, Vujić A, Hayat R, Šašić Zorić Lj & Đan M (2018) A new species of the genus *Chrysotoxum* Meigen, 1803 (Diptera: Syrphidae) from Turkey. Zoology in the Middle East, 64:244–252.

Speight MCD (2018) Species accounts of European Syrphidae, 2018. Syrph the Net, the database of European Syrphidae (Diptera), vol. 103, 302 pp., Syrph the Net publications, Dublin.

Thompson FC & Rotheray G (1998) Family Syrphidae. Pp. 81-139. In: Papp L & Darvas B (Eds), *Contributions to a Manual of Palaearctic Diptera 3*. Budapest: Science Herald.

Thompson FC, Rotheray GE & Zumbado MA (2010) Syrphidae (flower flies). Pp. 763–792. In: Brown BV, Borkent A, Cumming JM, Wood DM, Woodley Norman E & Zumbado MA (Eds), *Manual of Central American Diptera.* Ottawa: NRC Research Press.

Vockeroth JR (1969) A revision of the genera of the Syrphini (Diptera: Syrphidae). Memoirs of the Entomological Society of Canada, 62:1–176.

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

How complete are they? Comparing hoverfly diversity across different vegetation types in Southeast Europe

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Keywords: conservation; insects; Syrphidae; species pool; species richness

There is a worldwide recognition of the need for biodiversity conservation. In order to mitigate the negative impacts of biodiversity loss, reliable indicators of biodiversity need to be established. Diversity Completeness (DC) is one of the valuable metrics of biodiversity that can be used for identifying how complete a region is relative to its respective habitat-specific species pool, allowing comparison between biodiversity of different ecosystems. DC is calculated as the log ratio between observed species richness and dark diversity.

The objective of this study is to (i) calculate DC for different vegetation types in Southeast Europe as well as (ii) compare hoverfly diversity across these vegetation types. The results of this study showed that the lowest value of DC (-0.2) was in Southwest Balkan sub-Mediterranean mixed oak forests, while the highest value was in Beech and mixed beech forests (2.4).

Understanding how much of the habitat-specific species pool is actually realized, allows us to identify ecosystems that require conservation priority.

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New species in the *Eumerus ornatus* group (Diptera: Syrphidae) from the Republic of South Africa

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Keywords: Afrotropical Region; hoverflies; *Eumerus*; mtDNA; taxonomy

The phytophagous genus *Eumerus* Meigen, 1822 (Diptera: Syrphidae) is one of the most speciose syrphid genera, with more than 300 known species worldwide. It is widely distributed in the Palaearctic, Afrotropical, Oriental, and Australian Regions. Although very rich, the Afrotropical fauna is still insufficiently known. Leif Lyneborg, curator emeritus at the Natural History Museum of Denmark, made a monographic revision (in manuscript form) of the Afrotropical species of this genus and recognized more than 70 species new to science. Unfortunately, he did not manage to finish this revision before he died in 2006. During field investigations carried out in the Republic of South Africa from 2015 to 2017 within the "Fly High" project of the EU Horizon 2020 RISE programme, numerous adult *Eumerus* specimens were collected. Here, we present four new species within the *ornatus* group which are characterized by the enlarged male cerci. Contrary to European members of *ornatus* group, African species have a complex feathery structure within the cerci. We present main diagnostic morphological characters and discuss variability of molecular mtDNA COI sequences of the four new species.

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Hoverfly (Diptera:Syrphidae) diversity in Montenegro

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Keywords: syrphid fauna; Mediterranean; species richness; index of diversity

Montenegro is a country in the Mediterranean region and the Balkan Peninsula, with diverse ecosystems and remarkable biodiversity, which is considered an European biodiversity hotspot. Hoverfly fauna of Montenegro is well studied and up to now there are 370 registered species (Malidžan pers. comm.).

Species richness is the simplest, most intuitive and most frequently used measurement for characterizing the diversity of an assemblage. The actual species count in an area is usually the most relevant diversity measure in conservation biology, even when species abundances are available (Chao & Chiu 2016).

The aim of this study was to determine the species richness, to evaluate different indexes of diversity of Syrphidae in Montenegro and to present a review of seasonal phenology. The following indexes of diversity were evaluated: Brillouin, Margalef, Menhinick, Shannon and Simpson. Maps of the species richness and diversity indexes were created in Diva Gis software, version 7.1.7.

Results of the richness analyses showed that the northern part of country had the highest number of species. Most of the species were active during Spring and Summer. Moreover, the Northern part of Montenegro is the most diverse region, which implies that this area should be even more protected in addition to preserve important hoverfly species.

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References:

Chao A & Chiu CH (2016) Species richness: estimation andcomparison. Wiley StatsRef: Statistics Reference Online. 1–26.

New records to the Slovenian hoverfly fauna (Diptera: Syrphidae)

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Keywords: syrphids; diversity; Slovenia; new species

Slovenia is a country situated at the crossroads of Central Europe, the Mediterranean and the Balkan Penninsula. Although a small country, Slovenia has a very rich biodiversity due to its varied topography. Thus far, 310 hoverfly (Diptera: Syrphidae) species were recorded for Slovenia (De Groot & Govedič 2008; De Groot et al. 2010; Van Steenis et al. 2013; Janević & De Groot 2018). During 2018 and 2019 field surveys were carried out on 20 localities in Slovenia. Five species were recorded for the first time for the hoverfly fauna of Slovenia: *Brachyopa plena* Collin, 1939, *Brachyopa scutellaris* Robineau-Desvoidy, 1843, *Callicera aurata* (Rossi, 1790), *Cheilosia pedemontana* Rondani, 1857 and *Melangyna triangulifera* (Zetterstedt, 1843). Additionally, two undescribed species from the genus *Merodon* Meigen, 1803 were found, awaiting species descriptions (*Merodon* aff. *aureus* and *Merodon* aff. *cinereus*).

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References:

De Groot M & Govedič M (2008) Checklist of the hoverflies (Diptera, Syrphidae) of Slovenia. Acta Entomologica Slovenica 16(1):67–87.

De Groot M, Luštrik R, Faasen T, Fekonja D (2010) Additions and omissions to the list of hoverfly fauna (Diptera: Syrphidae) of Slovenia. Acta Entomologica Slovenica 18(2):77–86.

Janević D, De Groot M (2018) *Criorhina ranunculi* (Panzer) (Diptera: Syrphidae), a new hoverfly species for Slovenia. Acta Entomologica Slovenica 26(2):259–262.

Van Steenis W, De Groot M, Van Steenis J (2013) New data on the hoverflies (Diptera: Syrphidae) of Slovenia. Acta Entomologica Slovenica 21(2):131–162.

New *Paragus* Latreille, 1804 (Diptera, Syrphidae) species from Kazakhstan

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Keywords: hoverfly; flower fly; new species; taxonomy

The genus *Paragus* Latreille, 1804 consists of small-sized hoverflies with mainly black, but also with partly to completely red-orange to yellow abdomen. It is widely distributed on all continents except South America.

Eastern Palaearctic species of the genus *Paragus* have not been revised completely. The most comprehensive study on this genus from this region is published by Sorokina (2009).

Here we present one new *Paragus* species from Kazakhstan, found in Almaty province near Lepsy river. It belongs to subgenus *Paragus*, and morphologically it is close to *Paragus hyalopteri* Marcos-García et Rojo, 1994 and *Paragus radjabii* Gilasian et Sorokina, 2011. The male of the new species can be distinguished by the structure of the male terminalia (lateral lobe of aedeagus simple, rounded, without denticulate spine (triangular in *P. hyalopteri*; trapezoidal in *P. radjabii*); lingula rectangular-shaped (rhombus-shaped in *hyalopteri*; funnel-shaped in *radjabii*); superior lobe boomerang-shaped (trapezoidal in *P hyalopteri*; semitriangular in *P. radjabii*); surstylus long, in dorsal view curved, gradually tapering to the apex (short in *P. hyalopteri*; more elongated and apically pointed in *P. radjabii*)). The female of this new *Paragus* species is characterized by having the abdomen mainly yellow (in *P. hyalopteri* abdomen mainly black) and by the simple shape of tergum VII (in *P. radjabii* posterior margin of tergum VII with a thickening). We provide diagnostic characters and morphological comparison with similar species.

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References:

Sorokina VS (2009) Hoverflies of the genus *Paragus* Latr. (Diptera, Syrphidae) of Russia and adjacent countries. Entomological Review 89(3):351–366.

Characterisation of *Merodon albifrons+desuturinus* lineage using total evidence approach

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Keywords: intrageneric relationships; *Merodon*; morphological diagnosis; COI; 28S rRNA

Phylogenetic relationships of many taxa belonging to European species - richest hoverfly genus *Merodon* (Meigen, 1803) (Diptera: Syrphidae: Eristalinae) still remain unresolved. So far, several recent publications have dealt with taxa considered to constitute monophyletic groups (eg. Radenković et al. 2018; Mengual et al. 2006; Popović et al. 2015; Šašić et al. 2016). In this study we deal with the intrageneric phylogenetic relationships within the genus *Merodon*, with the focus on a putative subgenus comprising the taxa of the *albifrons*+ *desuturinus* species groups, which is recognized as a monophyletic lineage by total evidence approach. The study evaluated a total of 99 adult male morphological characters, of which a set of morphological diagnostic features clearly distinguishes taxa of *albifrons+desuturinus* lineage from all other *Merodon* taxa. Molecular characters used in a combined analysis were mitochondrial cytochrome c oxidase I and nuclear 28S rRNA genes. In total 66 taxa were analyzed, of which 60 *Merodon* taxa, 32 belonging to *albifrons*+ *desuturinus* lineage. Additionally, three previously recognized clades (putative subgenera) (*aureus*, *avidus- nigritarsis* and *natans*) were confirmed within the genus.

References:

Radenković S, Veličković N, Ssymank A, Obreht-Vidaković D, Đan M, Ståhls G,Veselić S & Vujić A (2018) Close relatives of Mediterranean endemo-relict hoverflies (Diptera, Syrphidae) in South Africa: Morphological and molecular evidence in the *Merodon melanocerus* subgroup. PlosOne 13(7):e0200805.

Popović D, Ačanski J, Đan M, Obreht D, Vujić A & Radenković S (2015) Sibling species delimitation and nomenclature of the *Merodon avidus* complex (Diptera: Syrphidae). European Journal of Entomology 112 (4):790–809.

Šašić Lj, Ačanski J, Vujić A, Ståhls G, Radenković S, Milić D, Obreht-Vidaković D & Đan M (2016) Molecular and Morphological Inference of Three Cryptic Species within the *Merodon aureus* Species Group (Diptera: Syrphidae). PLoS ONE 11(8):e0160001.

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

Flower flies communities associated with pollen transport in three land covers of Andean forest in the Quebrada las Delicas in Bogotá, Colombia

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Keywords: Hover flies; ecosystem services; bipartite networks; pollen loads; anthropized covers

Flower flies provide ecosystem services in different links of the trophic chain, been essential for pollination in natural forest. The present study correlates the Syrphidae abundance and pollen internal loads in three land covers of Andean forest of Colombia: riparian forest, discontinuous urban area (fabric), and high secondary vegetation. Adult flies were collected randomly using net in the warmest hours of the day and were preserved individually in Eppendorf tubes. Twenty-six Syrphid species and 25 pollen morphotypes were identified. First of all, based on principal components analysis of species abundance, the Syrphid communities are different on the discontinuous urban fabric, but similar on riparian forest and high secondary vegetation. Based on bipartite networks, we identified different types of links between Syrphids and plants. Preliminary results showed that the diet of Eristalinae includes abundant pollen of Asteraceae and among this, *Eristalis tenax* L. has the greatest pollen diversity, with 15 morphotypes. The diet of Syrphinae is diverse in terms of pollen morphotypes, in order of abundance Cunoniaceae, Piperaceae, Solanaceae and Rosaceae. In Syrphinae, *Orphnabaccha golbachi* (Fluke, 1950) was associated with the less anthropized land cover because its pollen loads belong to plants from preserved high Andean forest and its abundance was correlated with riparian forest. Eristalinae was linked with anthropized covers and correlated with discontinuous urban fabric as well as pollen from disturbed high Andean forest. This is the first contribution to understand the association of Syrphid communities and pollen transport in the Neotropics; further studies must include analysis about phenology and pollen external loads.

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