SAFEGUARD

Open database on pollinators individual based traits and phylogenies

Deliverable D1.2

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Safeguard
Safeguarding European wild pollinators

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Summary

This report describes the data collected within task 1.2 of Safeguard project, Traits & phylogenetic tree of European pollinators

- Lead: UNSPMF
- Contributors: UMONS, CSIC, RCISD, UFZ, UBB, IUCN
- Duration: 24 months
- Results on database: Regarding Syrphid flies, we collected trait data for 894 species and for 13 different traits, with addition of phylogenetic information on species, represented through GenBank numbers. For bees, 12 traits were provided. For butterflies, comprehensive data set on traits was published in 2020 (Middleton-Welling et al. 2020. *Scientific Data*), with 542 taxa and 25 traits, and is included in its original state in this dataset
- Collected data will be critical to assess trait correlates of population decline and dynamic linkages between plant and pollinator dynamics at functional group and species levels
- Reference of database published under Zenodo repository: DOI 10.5281/zenodo.8300431
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1. Introduction

Species richness and abundance have commonly been used as indicators to evaluate the state of a given ecosystem or ecosystem process. However, a diverse and species-rich community does not necessarily mean that ecosystem functions or services are intact and function properly. To better understand the relationship between biodiversity and (ecosystem) functioning, it is increasingly accepted that our focus needs to shift from taxonomic identity to the diversity of functional traits exhibited by species within a community. On the other hand, analyses of species traits and phylogenies can contribute in identifying the underlying mechanisms of species declines. Certain life history traits increase extinction risks of pollinators, e.g. large body size, small population ranges, or specialized ecology, but many other traits relevant for understanding trade-offs between resource limitation, environmental conditions and resilience to perturbation are not well studied. Task 1.2 of Safeguard aims to compile trait data for three pollinator groups: wild bees, syrphid flies and butterflies. These data will be compiled from published literature, direct measurements in collections, published databases, and from other WP (T2.3). The datasets compiled, which will also include phylogenetic data, will be critical to assess trait correlates of population decline and dynamic linkages between plant and pollinator dynamics at functional group and species levels (WP2).

2. Methodology

2.1. Data collection and description

2.1.1. Syrphid flies

For the syrphid traits, the starting point was the data compiled during PhD of Marija Miličić. Within this project, trait data for species present in Southeast Europe were compiled, primarily based on published literature (Speight, 2015, Speight et al., 2015), field observations and expert opinion.

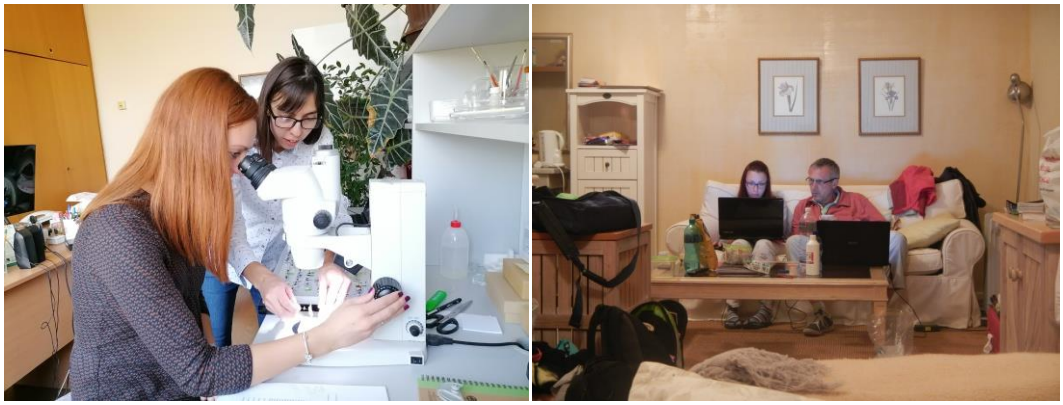

Figure 1: Obtaining trait data in the laboratory (a) and based on expert opinion.

This list was broadened to also include other European species. Finally, trait data was collected for 894 European species of syrphid flies.

The following trait categories are included in the matrix at the species level: Larval microhabitat, Larval food type, Duration of larval development, Inundation tolerance of larvae, Flight period, Body size of adults, Body structure, Body hairs, Distribution in Europe, Adult habitat type, Flying ability, Flight height, Human impact tolerance.

In cases when trait states could be presented as mutually exclusive, all trait states were coded in one column. But, in several cases when trait states were not mutually exclusive (e.g. flight period), then each trait state was presented in a separate column. Many of these traits are categorical (except two numeric ones: larval microhabitat and adult habitat type), but the majority can be transformed to ordinal, for specific analyses and answers to research questions.

Separate file following the database explains the traits and trait states used in the database.

Phylogenetic data is presented in the form of column in the dataset called GenBank Number, which refers to the sequence containing the 5'COI region.

2.1.2. Wild bees

The state of the art was the bee trait database of Stuart Roberts (formerly from Reading University). The database includes six traits: Inter Tegular Distance (ITD), sociality, nesting trait, lecty, buzz pollinator and voltinism.
We extended this data, mainly the ITD data, using specimens from:

-Private reference collections (taxonomists): Achik Dorshin, Simone Flaminio, Thomas James Wood and Denis Michez).
-Public reference collections (museums and universities): Linz Museum, Lund University and University of Mons.
To characterize the nesting ecology of bees we split the nesting information into five traits: nest active construction, nest position, nesting material, nesting area and nesting method.
We collected data of two new traits: hairiness and time before heat stupor (THS). THS is an estimation of bee resistance to heat stress. We organized the collection of THS in five European countries (Greece, Italy, Belgium, France and Sweden). The field work was conducted by eight teams including students, trainees, new collaborators and UMONS team. The hairiness is a quantitative measurement of hair length and density (Roquer et al. 2020). This trait was measured using the specimens collected by the different teams and bees from the reference collections.

Final dataset contains 12 traits. All species of European bees (2138) are included in the list, but for a portion of them none of the trait data is available.

Separate file following the database explains the traits and trait states used in the database.

Phylogenetic data is presented in the form of column in the dataset called GenBank Number, which refers to the sequence containing the 5'COI region.

2.1.3. Butterflies

Regarding butterflies, a comprehensive data set on traits was published in 2020 (Middleton-Welling et al. 2020. Scientific Data). These data are included in our dataset in its original form, and the separate file accompanying the database gives the link to the original file explaining the coding used for the traits. Phylogenetic information for butterflies is presented in Kristensen et al. (2007) and is not included in the database.

3. Data management

The overall approach of Safeguard project aims to make data and results visible and freely accessible and to ensure long term data preservation. For trait data, in accordance with FAIR data principles, the database is hosted on Zenodo platform (https://zenodo.org/, funded by CERN, OpenAIRE, and Horizon 2020). Data will be published on 2023-11-01. Additional two months after the official Safeguard deliverable will be used to conduct another round of data validation. Data will be openly available at: 10.5281/zenodo.8300431, after the embargo period which will last until the manuscript of the paper describing all datasets is being prepared (end of embargo period 2025-08-31). It is followed by appropriate metadata. Metadata input is recorded at the time of dataset creation.

The database is shared under Creative Commons Attribution 4.0 International.

4. Data usage

In the previous years, functional traits of bees, butterflies and syrphid flies were used to answer different research questions, such as to compare taxonomic and functional diversity in urban settings (Normandin et al., 2017), to assess whether different functional groups show different temporal trajectories (Eskildsen et al., 2015), and to

examine which functional traits promote so-called dark diversity in species (Miličić et al., 2020).

However, compiling information on additional traits and on additional species of different pollinator groups and making them openly available to the entire research community through Safeguard project will help explore new research trajectories, predominantly related to assessing pollinator declines and plant-pollinator networks.

5. References

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