From Urban to Alpine Ecosystems: Pollinators as Bioindicators of Environmental Health

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1 Introduction

- Pollinators play a key role in the maintenance of environmental health and provide invaluable services to humanity i.e. pollination, waste disposal, nutrient recycling, and many more (Nath et al., 2023).
- Several studies demonstrate that wild pollinator diversity has globally declined over recent decades (Carvalheiro et al., 2013), (Eisenhauer et al., 2019).
- Climate change, habitat loss and fragmentation, parasite infection and invasion of alien species have been proposed as some of the prime suspects responsible for the decline (Hallmann et al., 2017), as well as pesticides exposure (Sponsler et al., 2019).
- This research contributes to a deeper understanding of environmental health conditions and assess exposure to agrochemicals and other pollutants

This study investigates the correlation between the presence of three key pollinators, Apoidea (Hymenoptera), Lepidoptera and Syrphidae (Diptera) and environmental health conditions

Fig. D *Xylocopa violacea*, Trento. Author: Nicola Orempuller

Fig. E Male *Megachile*, Trento. Author: Nicola Orempuller

3 Results

- In Trento over 600 individuals were collected, showing off five families (Apidae, Halictidae, Andrenidae, Megachilidae, and Colletidae) and many genera including *Ceratina*, *Halictus*, *Lasioglossum*, *Osmia*, *Megachile* **(Fig. E)**, *Rhodanthidium*, *Anthidium*, *Anthophora*, *Xylocopa* **(Fig. D)** and *Bombus*. Interestingly, the cuckoo bumblebee *B. vestalis* and the genus *Sphecodes* were also found.
- So far, in each pollen samples chemical revealed the presence of heavy metals (Al, Cd, Cu, Pb), herbicides (as in glyphosate, metamitron, pendimethalin), insecticides (chlorantraniliprole, acetamiprid, ***carbaryl**, etofenprox, pirimicarb) and 25 fungicides (for example folpet, captan, dithiocarbamates, ***tolylfluanid**, ***fludioxonid** ecc)

***carbaryl** was banned from the EU in 2011, **tolylfluanid** is no longer legal in EU since 2023, **fludioxonid** is legal in EU until 2026 but might not be renewed due to high public health risk

- At Stelvio National Park over 38 species of Lepidoptera were observed and identified while the most frequent genera include Erebia, Argynnis and Coenonympha.

2 Methods

Data were collected between May and September in two areas: 1) Trento and 2) Stelvio National Park

1. Once per month, more than 600 Apoidea were collected and observed from 13 stations in Trento using pan traps and transects (**Fig. B, Fig. C**)
1. Beehives with pollen traps were stationed in the same 13 stations abovementioned and pollen was collected for chemical and palynological analyses (**Fig. A, Fig. F**)
2. Apoidea, Lepidoptera and Hoverflies were monitored using transects twice per month, usually beginning and end of the month between ~ m 1460 and ~ m 2280 s.l.m

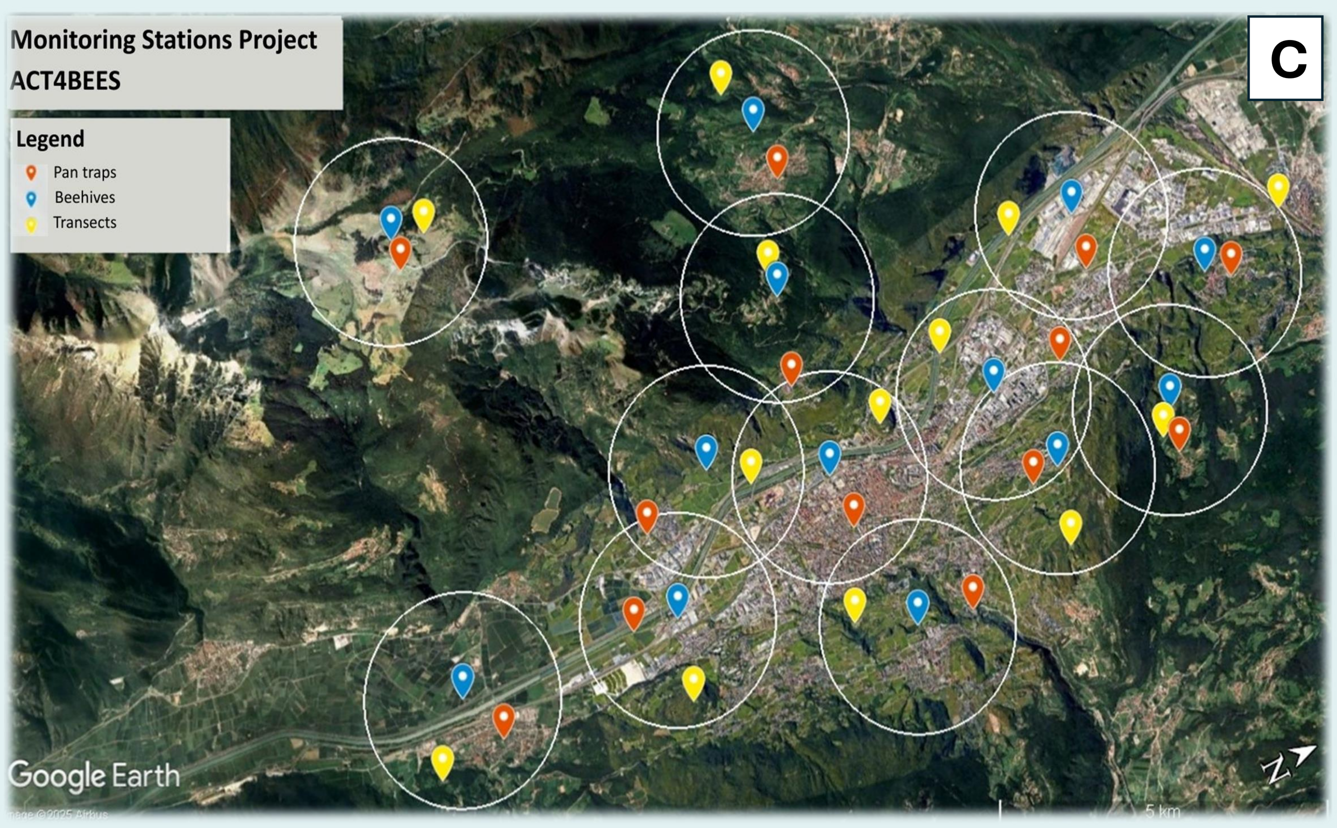

Fig. F Pollen sample, July, Trento

Fig. G Example of transect in "Fratte basse", Stelvio National Park. Final report 2022

Fig. H *Erebia euryale*, Stelvio National Park

4 Discussion and Conclusion

The study is part of a pluriannual monitoring of pollinators at Stelvio National Park. The most common genera of Lepidoptera found at Stelvio national park in 2025 were also the most frequent in 2022.

This study is also a first broad Apoidea monitoring of urban and agricultural areas of Trento and a wider monitoring of pesticides within honeybees pollen, already started in 2023 with BeeTrento project. Less presence or absence of Apoidea was observed in mowed areas.

For future studies in Trento, we want to implement the number of transects and pan traps, in order to have more samples. We also want to focus on checking *B. terrestris* colonies and pesticides residues on their pollen as additional environmental health research

5 References

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COHESION ITALY 21-27 ALTO ADIGE SÜDTIROL
Co-funded by the European Union
unibz Freie Universität Bozen Libera Università di Bolzano Università Liedia de Bulsan

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