OP-266 [Pollination and Bee Flora]
Honey bees are generalist pollinators, but the bulk of pollen supply was from less than 20 plants in rural-urban mosaic landscapes in Denmark

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Background/purpose
Pollen is an important source of protein, lipids and micro-nutrients for insects. The composition of pollen diet, specifically pollen diversity, has been documented to impact honey bee health. Honey bees forage within flight distance of their hive, in Northern Europe typically in rural-urban mosaic landscapes.

Problem description
We investigated how pollen diversity and proportional abundance of key pollen types was influenced by season, study year, and landscape composition.

Methodology
Using pollen traps, pollen samples were collected every three weeks during the flowering season in two years from 25 apiaries. Study sites were rural-urban landscapes in Denmark with different proportions of agriculture, urban and nature areas. Botanical composition of pollen samples was determined by palynological analysis (morphological determination by microscopy). For each sample, pollen diversity and relative abundance of all pollen types found in >1% of a sample was calculated. Effects of study year, season and landscape parameters were tested using GLMMs.

Results and conclusion
A total of 211 different pollen types belonging to 85 plant families were detected in a total of 300 pollen samples. Pollen diversity varied seasonally and annually, and pollen diversity was positively related the area of green urban spaces in the surrounding landscape. Only 17 pollen types were found in at least 15 samples. These were found in both study years, and were strongly influenced by season, but mostly not by landscape parameters.

Practical implications for beekeepers
Diversity of pollen varied seasonally, with a higher diversity in late season, and higher pollen diversity in landscapes with urban green areas. However, the bulk of pollen collected by honey bees belonged to less than 20 pollen types, which were mostly present in all study landscapes, regardless of composition. These key pollen plants were mass-flowering crops as well as wild flowers.

Honey bee pollen supply in Denmark

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Apimondia 2025 Bee Plant symposium 25 September 2025

Pollen diet composition

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Journal of Applied Ecology

BRITISH ECOLOGICAL SOCIETY

Journal of Applied Ecology 2017, **54**, 1161–1170 doi: 10.1111/1365-2664.12836

The carry-over effects of pollen shortage decrease the survival of honeybee colonies in farmlands

ROYAL SOCIETY OPEN SCIENCE

royalsocietypublishing.org/journal/rsos

Interacting stressors matter: diet quality and virus infection in honeybee health

OPEN ACCESS Freely available online

PLOS ONE

Influence of Pollen Nutrition on Honey Bee Health: Do Pollen Quality and Diversity Matter?

SCIENTIFIC REPORTS

OPEN

Received: 8 February 2017
Accepted: 13 June 2017
Published online: 24 July 2017

Elucidating the mechanisms underlying the beneficial health effects of dietary pollen on honey bees (*Apis mellifera*) infested by *Varroa* mite ectoparasites

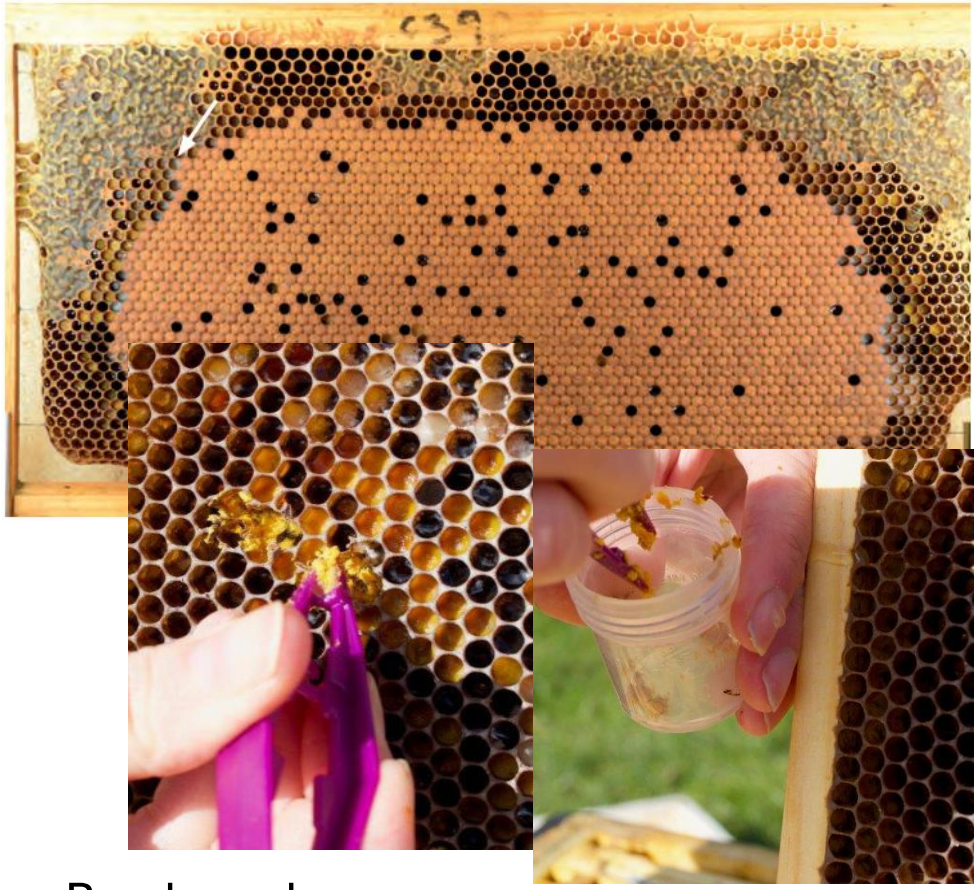
Effects of season, year and landscape on pollen supply?

Honey bee pollen supply projects

COLOSS project 2014-2015

Corbiculate pollen https://coloss.org/c-s-i-pollen
308 samples, 3-9 samples pr apiary pr year
25 apiaries
Temporal variation (year-to year and season)
Spatial variation

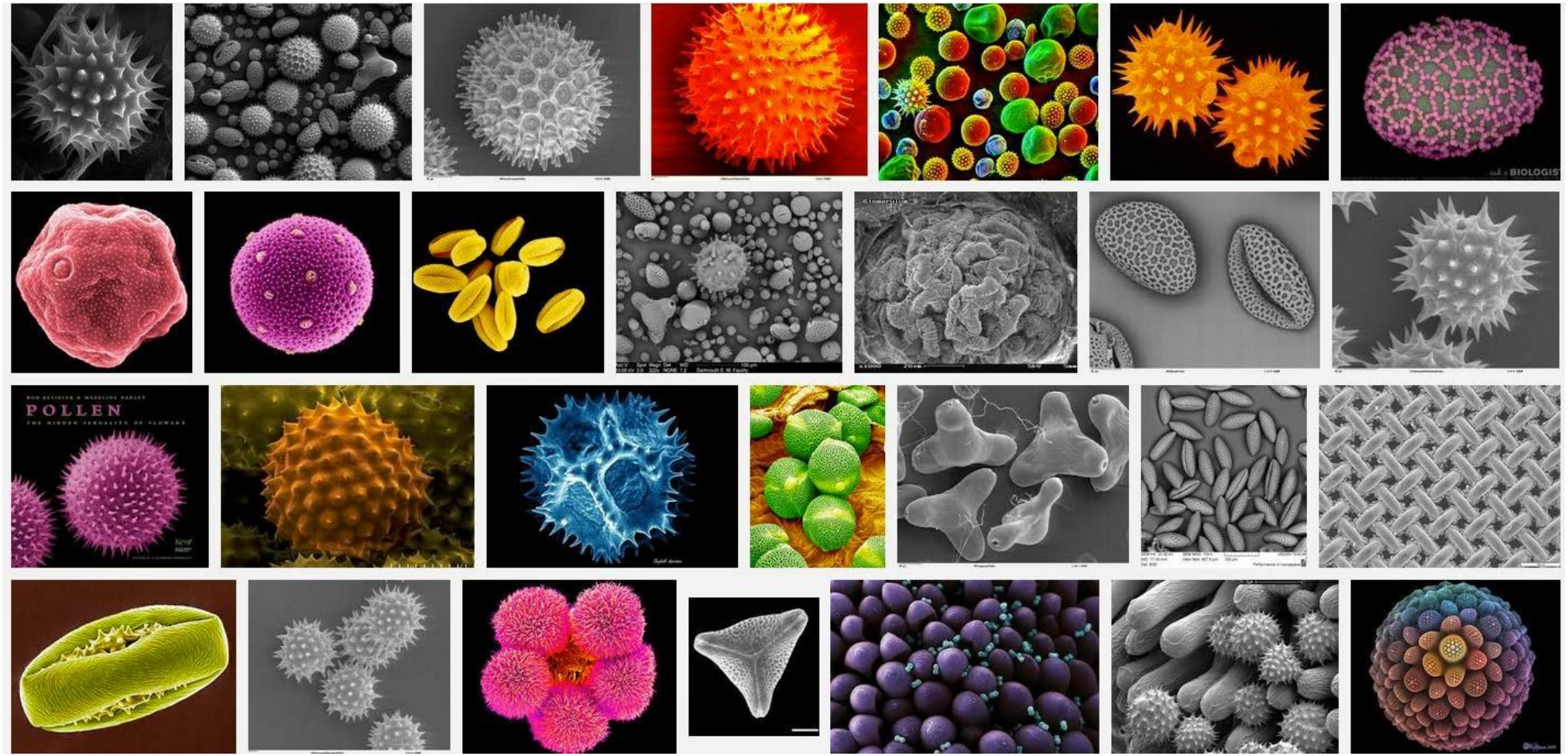
Bee bread project
National DK project 2020-2021



Bee bread
311 samples, 6-10 samples pr apiary
39 apiaries
Spatial variation
Season

Pollen identification by palynology

Pollen type: mostly plant genus



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Analysis

Palynological analysis

- Pollen richness (number of pollen types per sample) (**qualitative)**
- Pollen prevalence (number of samples) and abundance (number of grains) (**quantitative)**

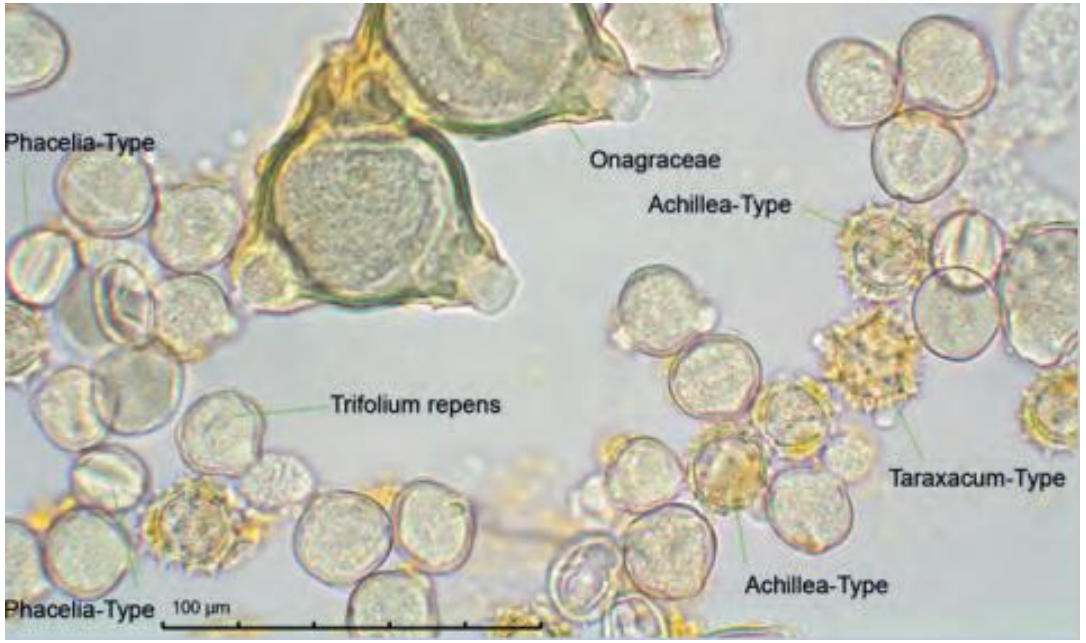
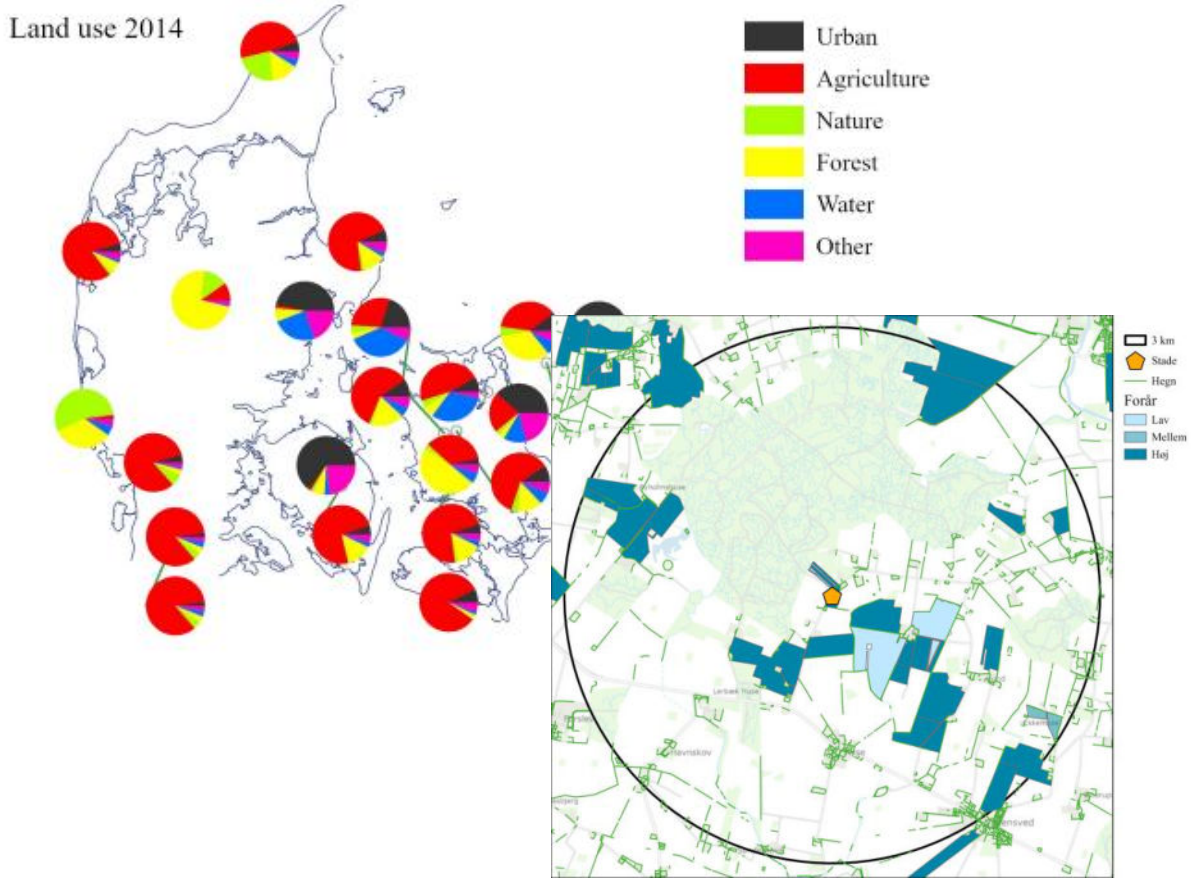


Photo: Ghalia Kassem

Variables in General linear models

- Season (April-October)
- Study years
- Landscape composition (radius 3 km)



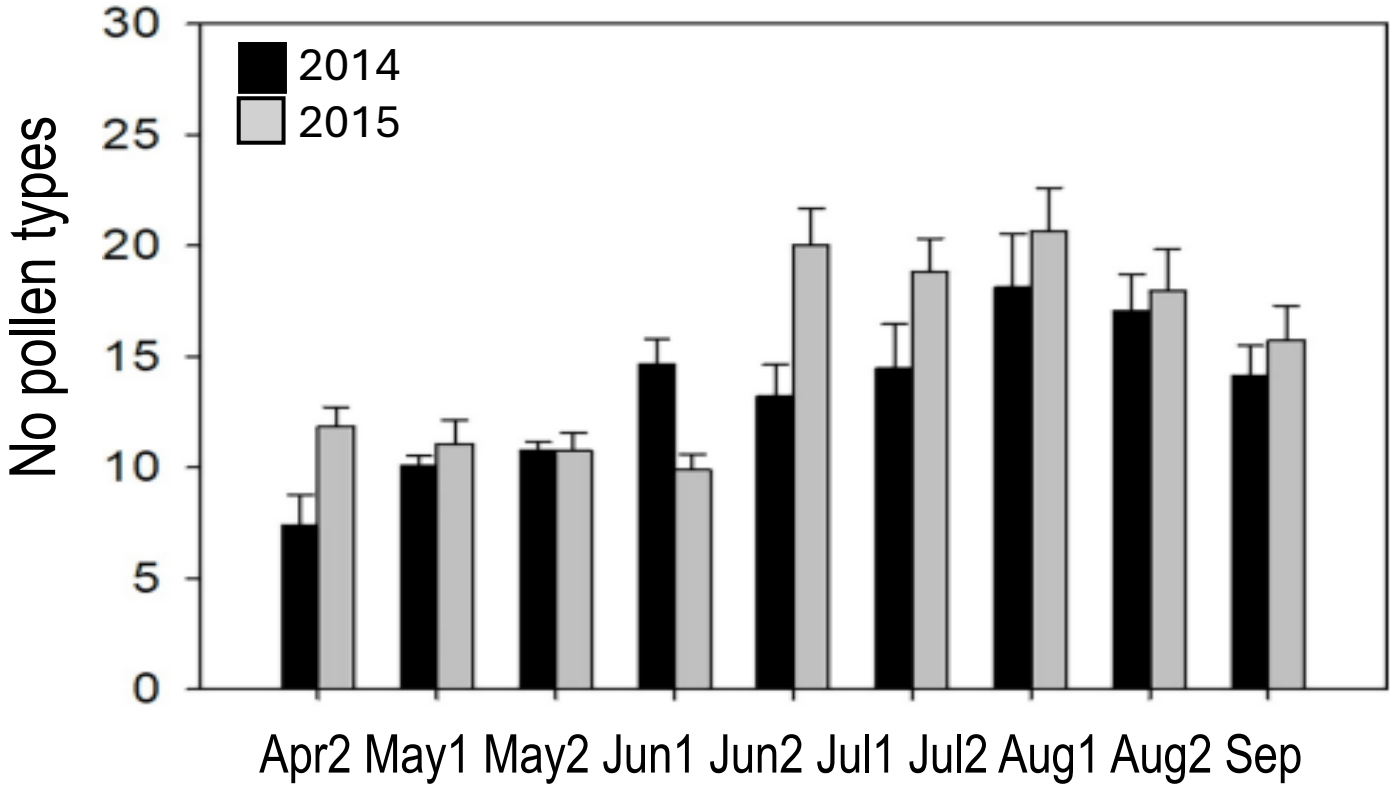
Pollen richness

Total pollen types: 211

C.S.I. Pollen

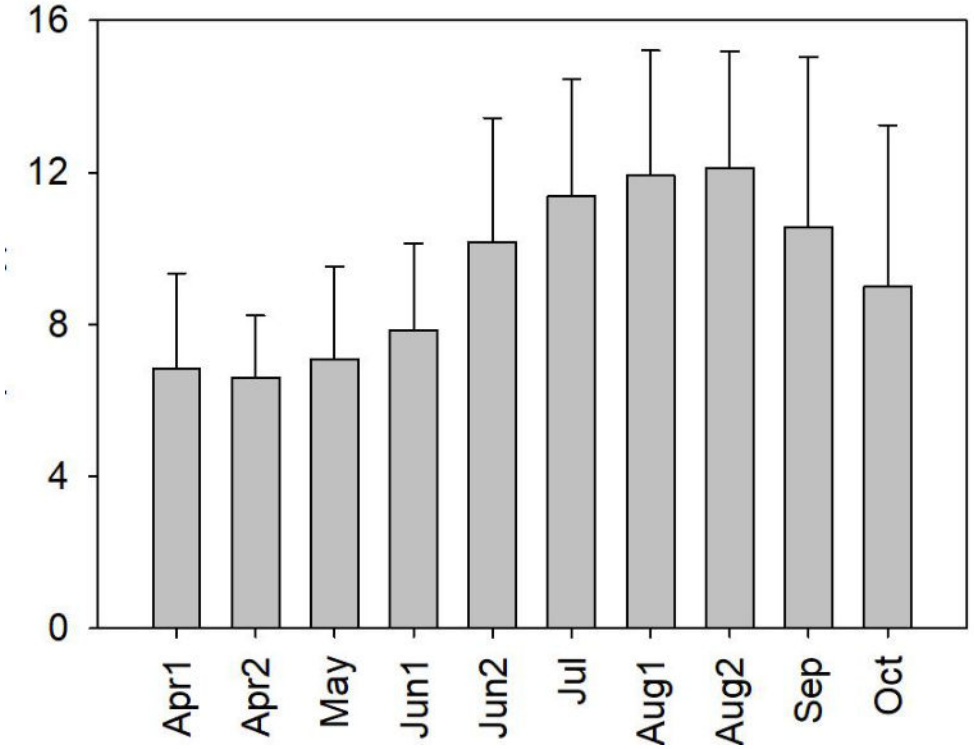
Citizen Scientist Investigation on pollen diversity forage available to honey bees

Pollen types per sample



Dupont et al, 2025 *PlosONE*

Total pollen types: 105



Dupont et al, 2022 *DCE report*

Pollen prevalence and abundance

Pollen types

Abundance >1% of sample

Prevalence >15 samples

17 pollen types

22 pollen types

Spring

Summer

Late summer

Photos: Yoko L. Dupont

Take home messages

Honey bee pollen supply

- High pollen richness (100-200 pollen types)
- 20 abundant/prevalent pollen types

Spatial variation

- Pollen richness depends on landscape (highest in urban landscapes)
- 20 abundant/prevalent pollen types are consistent across landscapes

Temporal variation

- Year-to-year variation in pollen richness
- Seasonal variation in pollen richness, peak in late summer
- 20 abundant/prevalent pollen types are consistent across years
- Temporal specialization on few abundant pollen types

Thank you!

Volunteer beekeepers

Asger Søgaard Jørgensen (coordinator of CSI Pollen Denmark)

Sjef van der Steen (coordinator of CSI Pollen COLOSS)

Anna La Cour and Ghalia Kassem for lab work

Funding: National Danish Beekeeping Program

PLOS ONE

RESEARCH ARTICLE

Spatio-temporal variation in pollen collected by honey bees (*Apis mellifera*) in rural-urban mosaic landscapes in Northern Europe

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