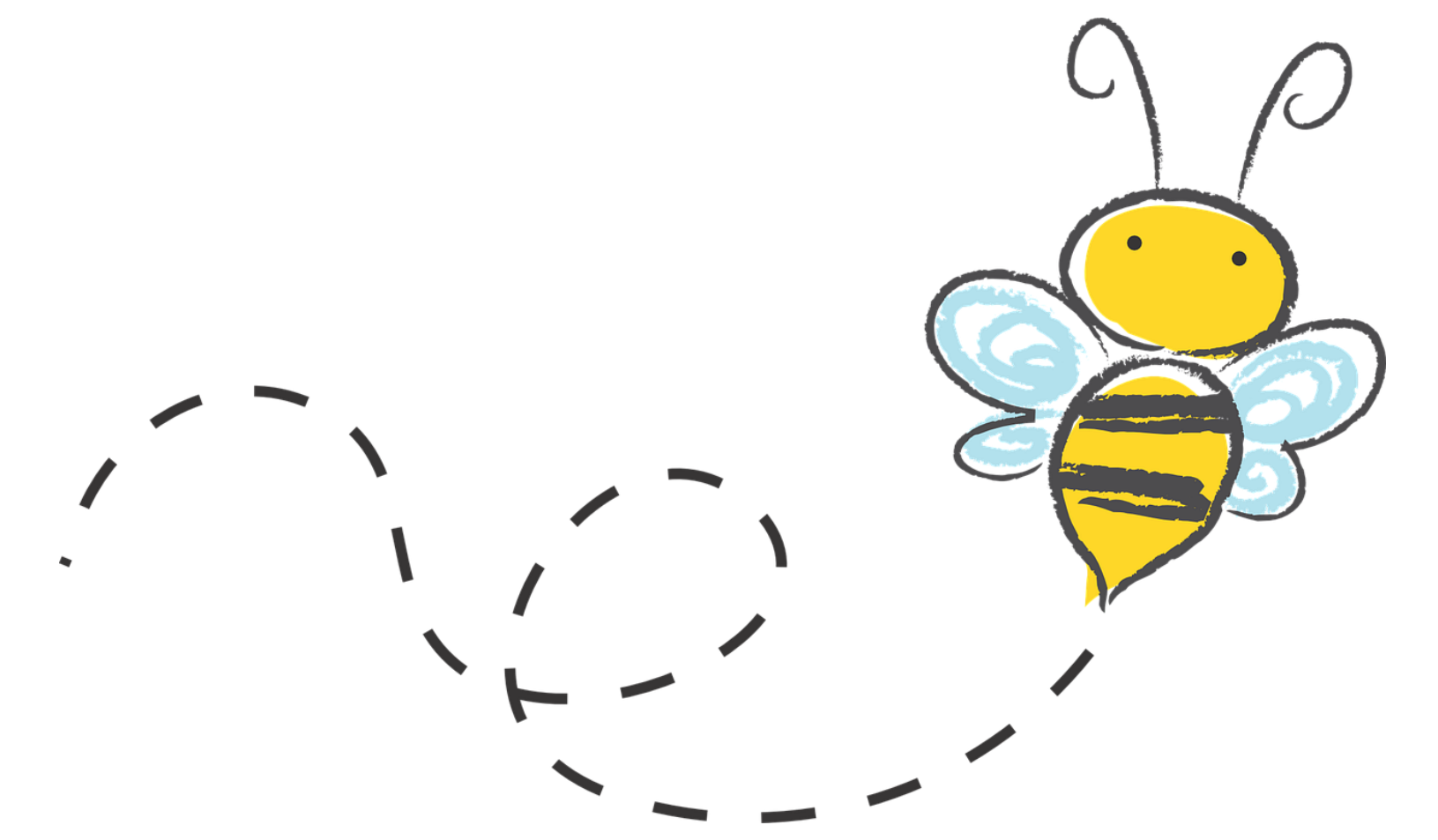


# The bees' weeds: Investigating the spatial and temporal pollen usage patterns of *Osmia* bees in apple orchards



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## Introduction

Pollination is key to plant reproduction, and can be carried out by several species, including bees. Native bees are an integral pollinator group that can be an important alternative to honey bees (*Apis mellifera*) (Garibaldi et al. 2013). Knowledge of the pollen usage patterns of native bees can help evaluate the potential for a given habitat to support native bee populations.

*Osmia* spp. (commonly known as mason bees) are excellent apple orchard pollinators. However, little is known about their pollen usage patterns and population dynamics. It is also unclear whether *Osmia* populations in orchards are sustained by fruit-tree pollen or are reliant on other pollen sources – especially later in the season, after fruit-trees finish flowering.

## Goals

1. Compare the abundance of mason bees between orchards and nearby semi-natural ("natural") sites with apple trees.
2. Determine whether pollen usage patterns differ seasonally between orchard and "natural" sites.



*Osmia ribifloris* USDA Photo by Jack Dykinga, public domain.  
[https://commons.wikimedia.org/wiki/File:Osmia\\_ribifloris\\_bee.jpg](https://commons.wikimedia.org/wiki/File:Osmia_ribifloris_bee.jpg)

## References

- Lucas A. Garibaldi1, (2013). *Wild Pollinators Enhance Fruit Set of Crops Regardless of Honey Bee Abundance*. Retrieved from <https://pdfs.semanticscholar.org/5182/c9929379a88457fe40f9138f9a0c65bfc2d.pdf>
- Cartoons from <https://pixabay.com/en/bee-cartoon-bumble-honey-icon-705412/>

## Methods

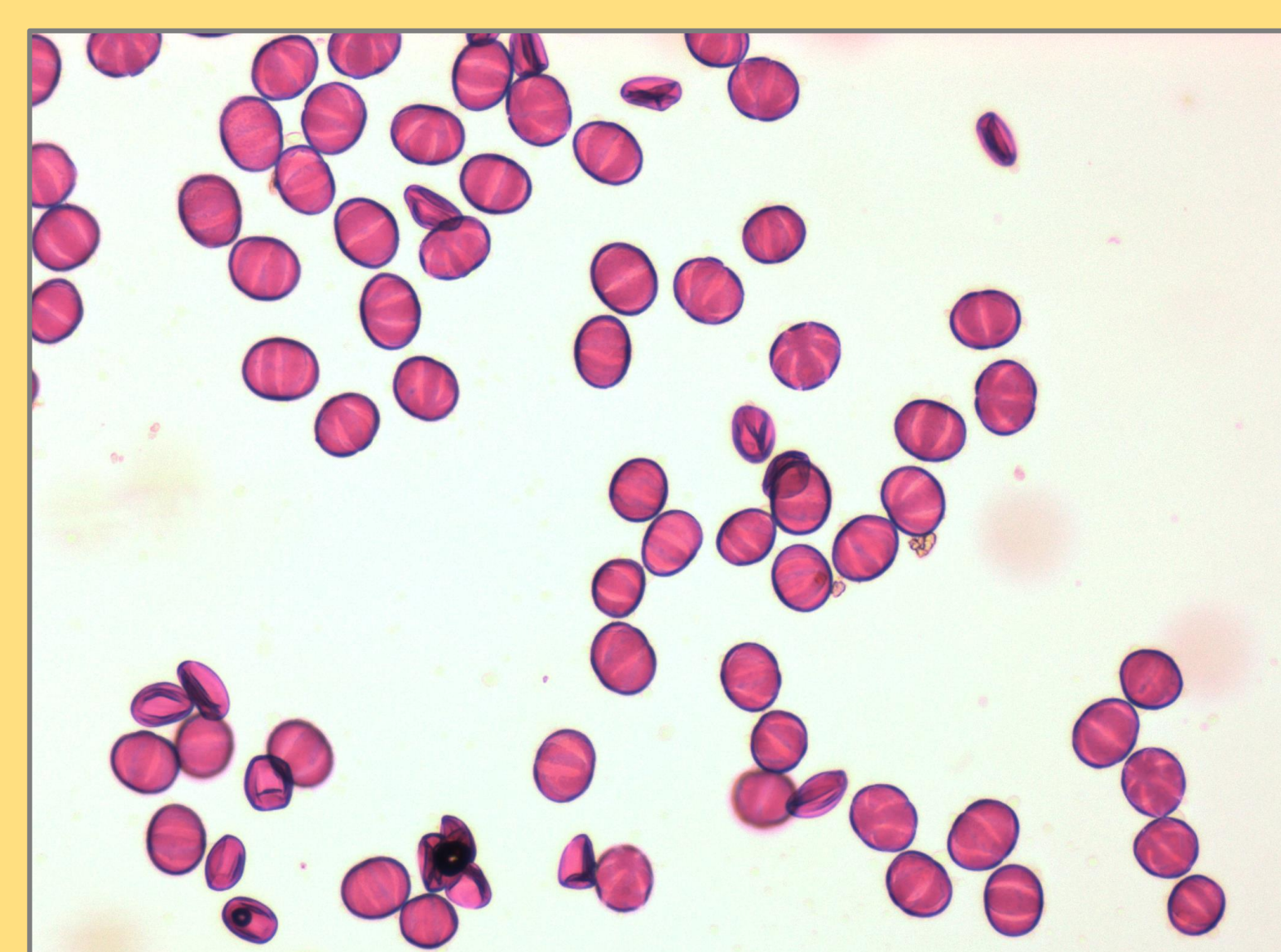
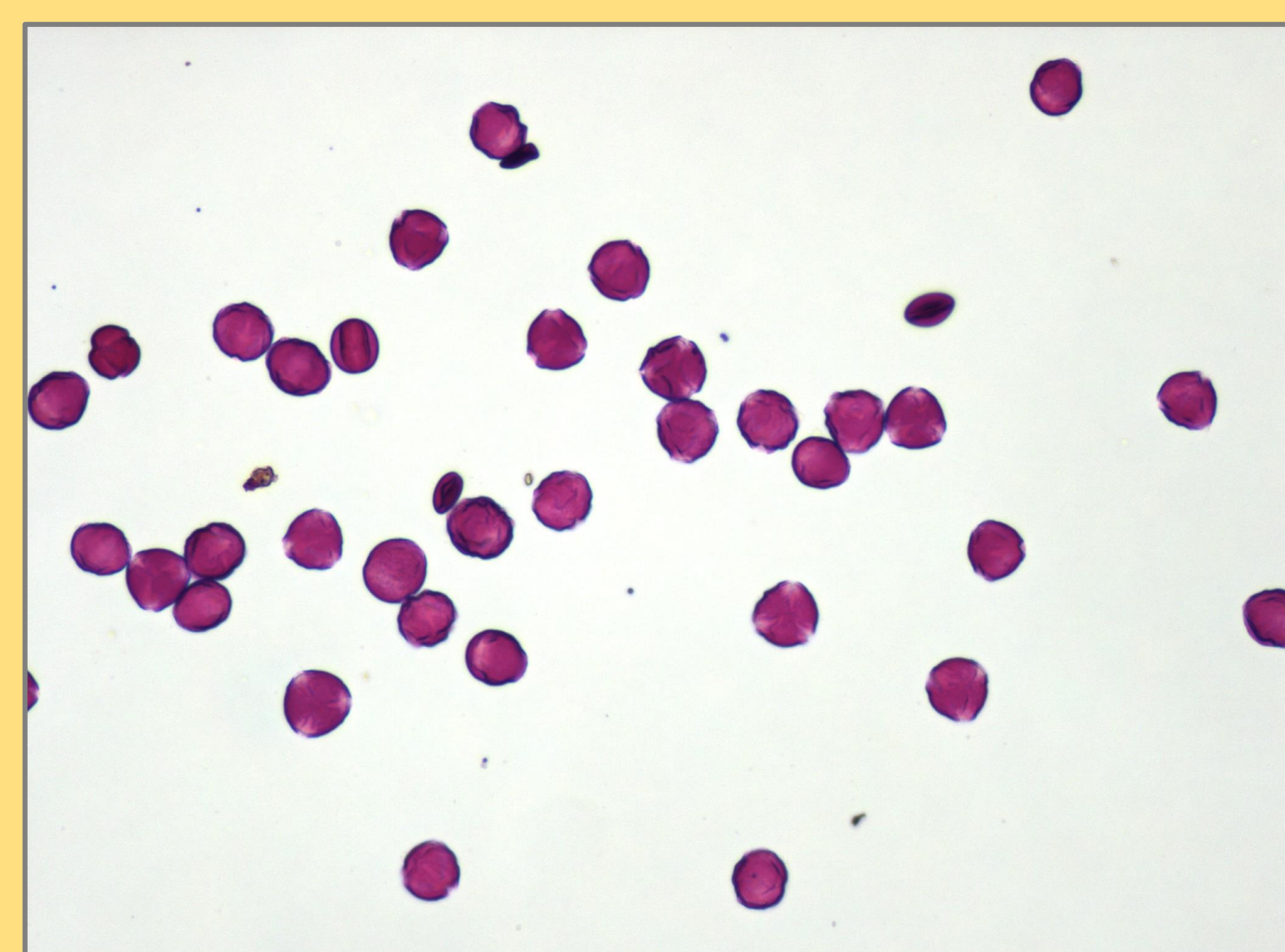
1. Experimental trap-nests from seven orchard and eight natural sites were opened and identified to assess mason bee abundance.



2a. The first and last brood cells of each nest were sampled for pollen and mounted on slides with fuchsin stain.



2b. The proportion of pollen of each type in each nest was determined by comparing pollen grains to a reference library.

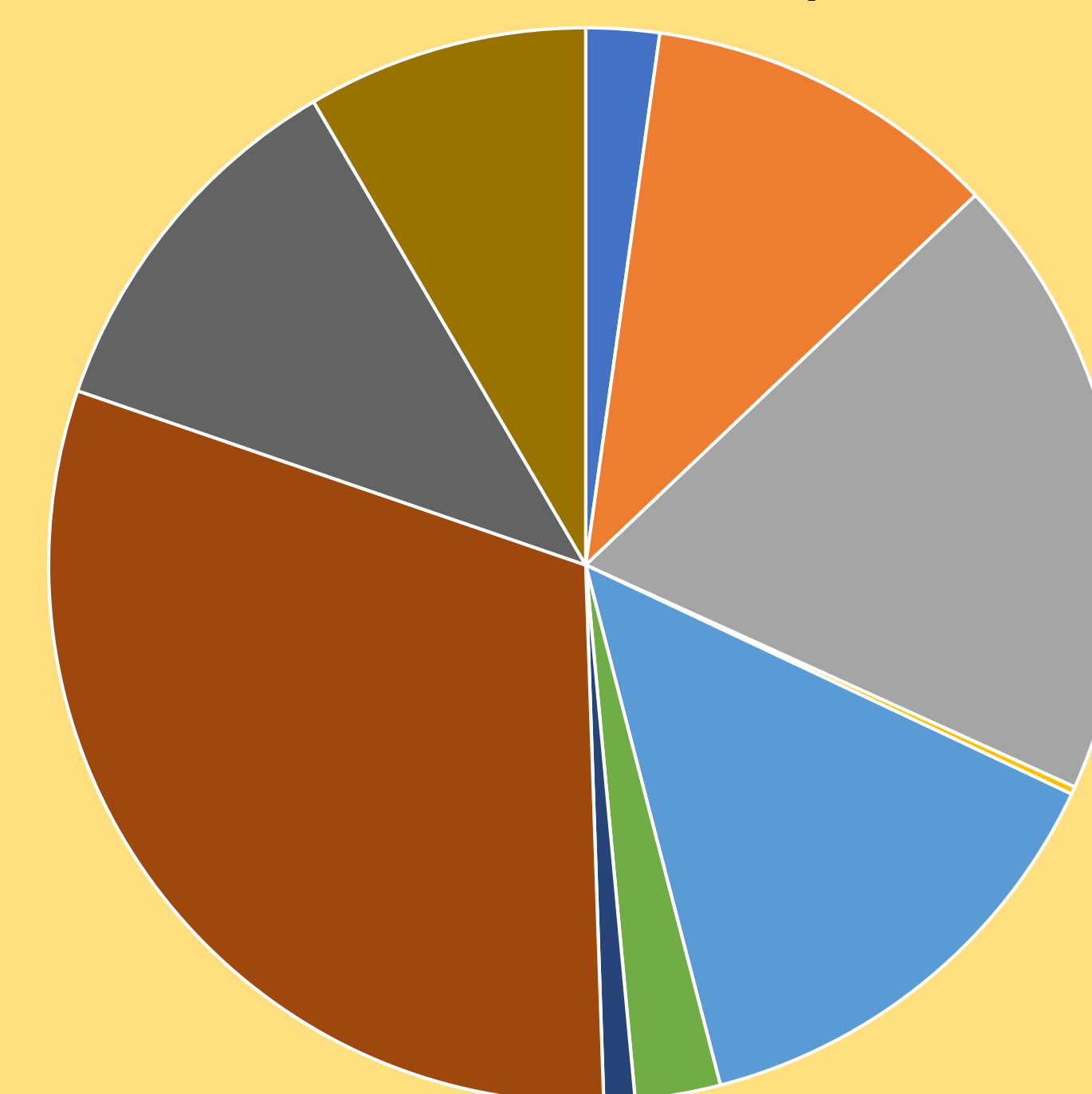


**Figure 1.** Upper image: Rosaceae pollen. Lower image: Lamiaceae pollen

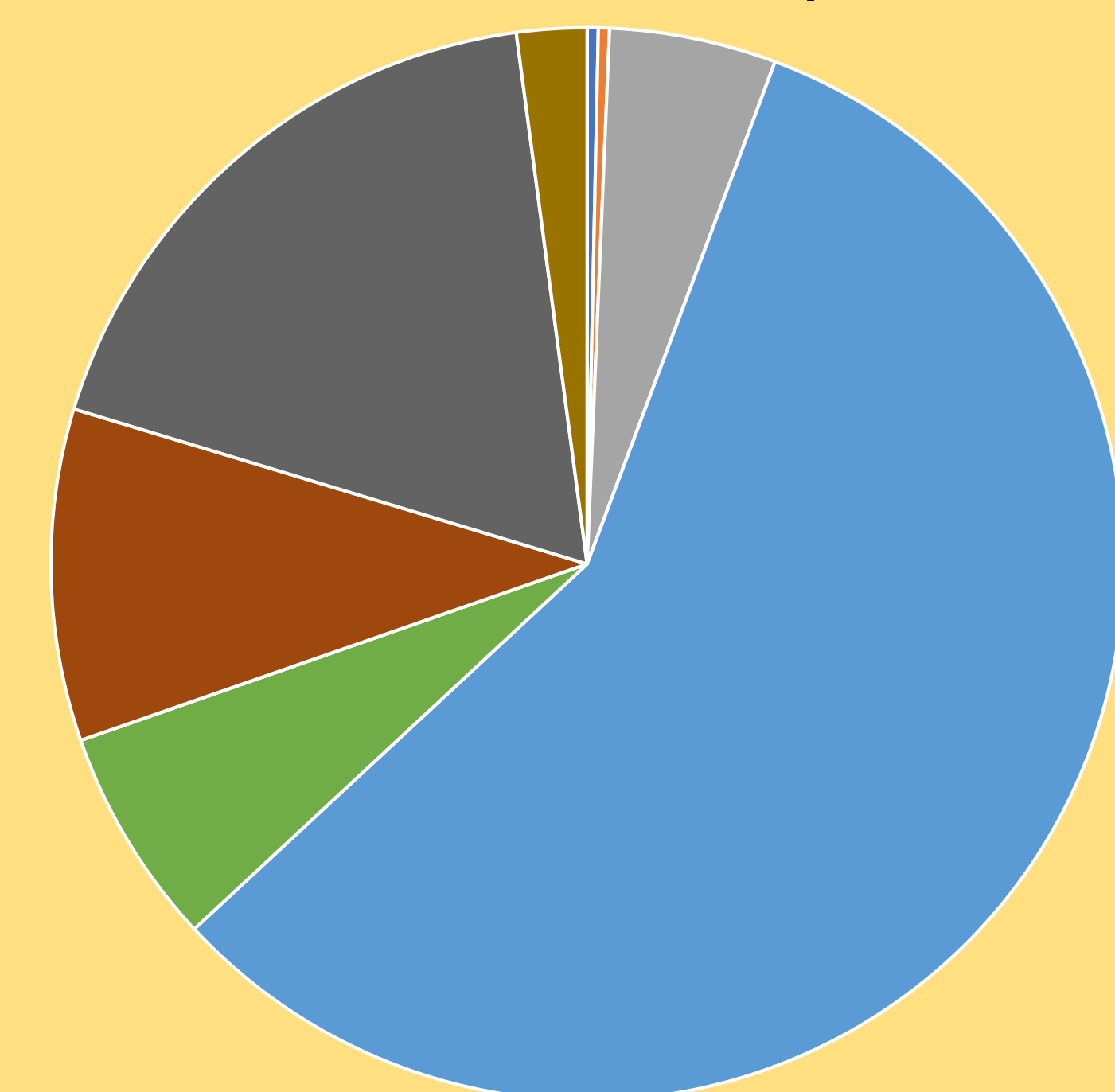
## Results

1. There was no significant difference in the number of surviving *Osmia* brood cells between natural and orchard sites. The number of surviving brood cells in natural and orchard sites was 83 (s.d.=50.9) and 88.8 (s.d.=76.7), respectively.

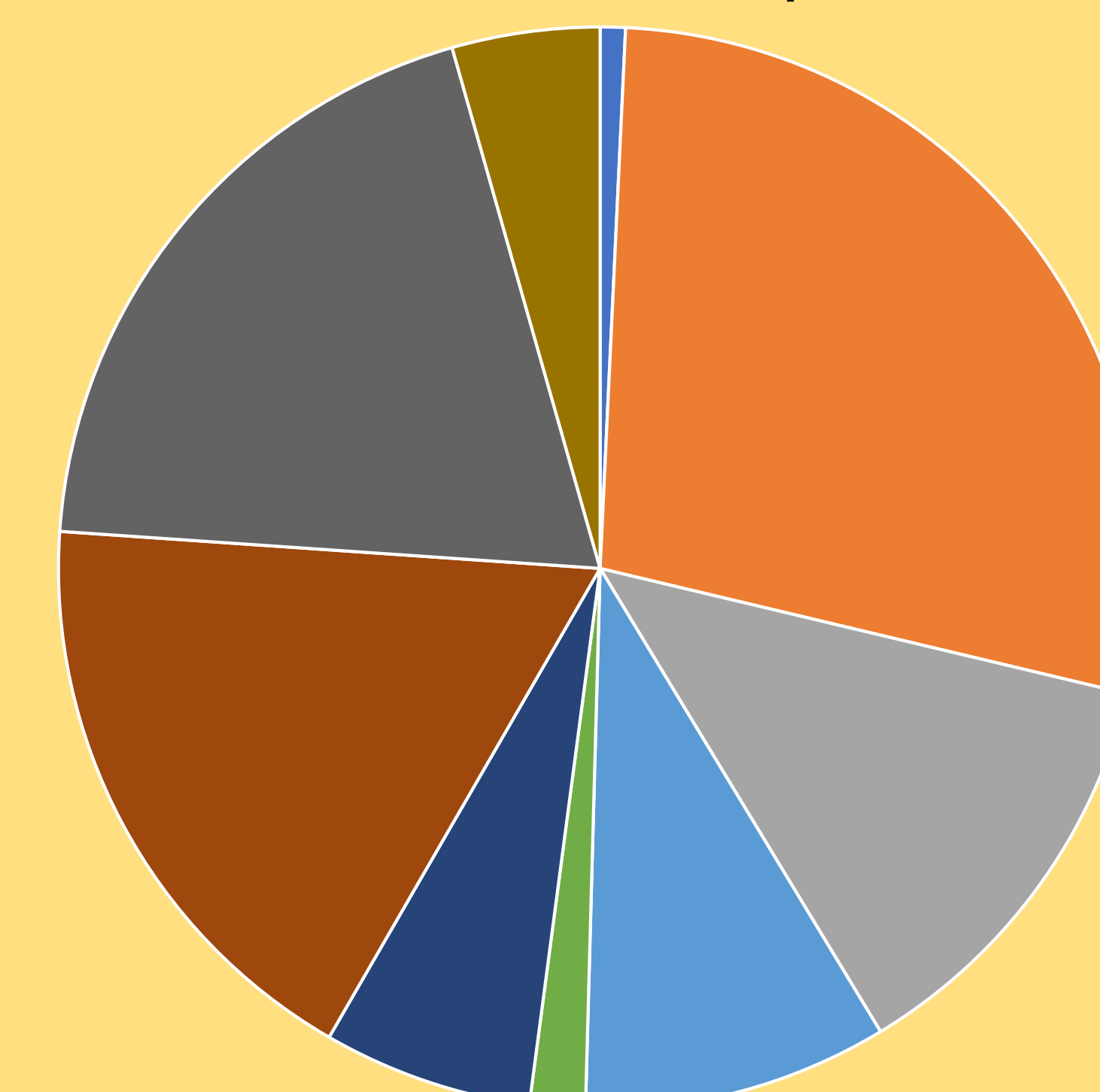
### 2. Orchard sites first period



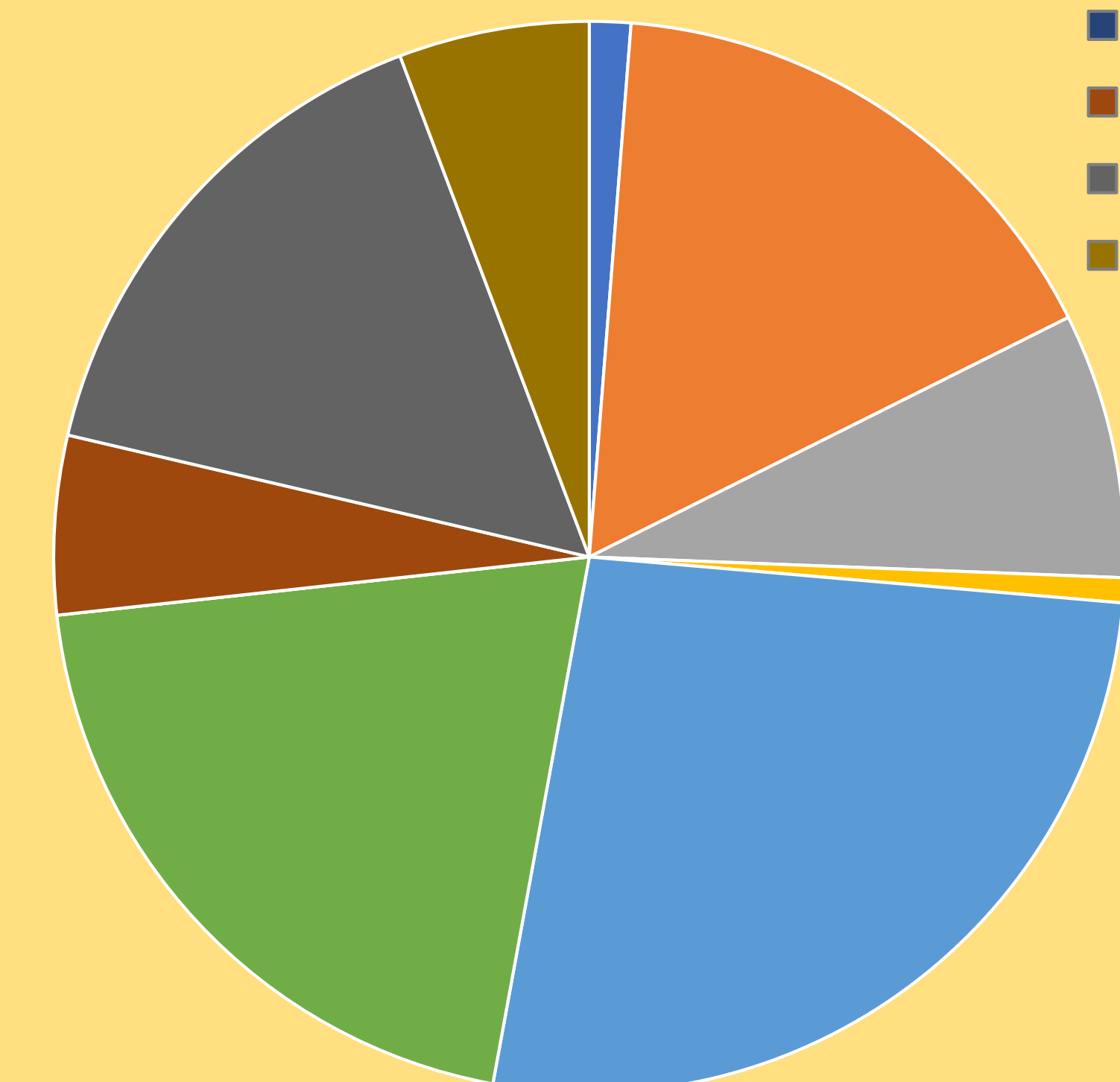
### Orchard sites last period



### Natural sites first period



### Natural sites last period



■ Asteraceae  
■ Brassicaceae  
■ Caprifoliaceae  
■ Caryophyllaceae  
■ Cornaceae  
■ Fabaceae  
■ Lamiaceae  
■ Rosaceae  
■ Unknown  
■ Monocots

**Figure 2.** Mean proportions of different pollen types used by *Osmia* bees in orchard and natural sites during the summer of 2017. "First period": 8 – 28 May; "last period" 14 June – 15 July. N = 7 orchard and 8 natural sites.

## Conclusions

- Rosaceae pollen such as apple tree pollen was the primary type used by *Osmia* during May 2017 at orchard sites, which corresponds to the flowering season of this family of plants.
- Cornaceae pollen was an important source for *Osmia* throughout the whole summer season in both natural and orchard sites, but became more important as the season progressed.
- The most important pollen sources towards the end of the season in natural sites were Fabaceae (legumes) and Cornaceae (shrubs such as dogwood).
- These results suggest that as the flowering season of Rosaceae ended, Fabaceae and Cornaceae pollen became important for *Osmia* bees.
- Based off the number of surviving cells, *Osmia* seem to be supported on apple orchards even after the flowering season of Rosaceae, which could be due to other pollen sources, such as Cornaceae, being present in close proximity.

## Recommendations

To sustain native bee populations, growers should plant species that *Osmia* bees used the most, including dogwood (Cornaceae) and legumes (Fabaceae), in close enough proximity that their pollen can be used effectively.

## Acknowledgments

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