Variability of Pollinator Specialization Over Time

Assessing the impact of floral typology on pollinator specialization

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Introduction

We analyzed pollinator specialization in a home garden between April and October 2020 as the floral community shifted using bipartite network analysis (BNA). BNA is a key tool in understanding the function of each species in a network[1]. However the incorporation of change over time in BNA is recent and needs further development[2]—despite different flowers having very different phenologies. In particular, we extended Corbet's, and Ellis & Ellis-Adams' flower and insect typologies to analyze whether the availability of preferred food sources impacted specialization and niche overlap.[3,4] This work provides valuable insight to restoration efforts which seek to maximize pollinator biodiversity and minimize planting expenses.

- Specialization will positively correlate to abundance of well-suited plants
- Niche overlap will be lower than predicted by a null model

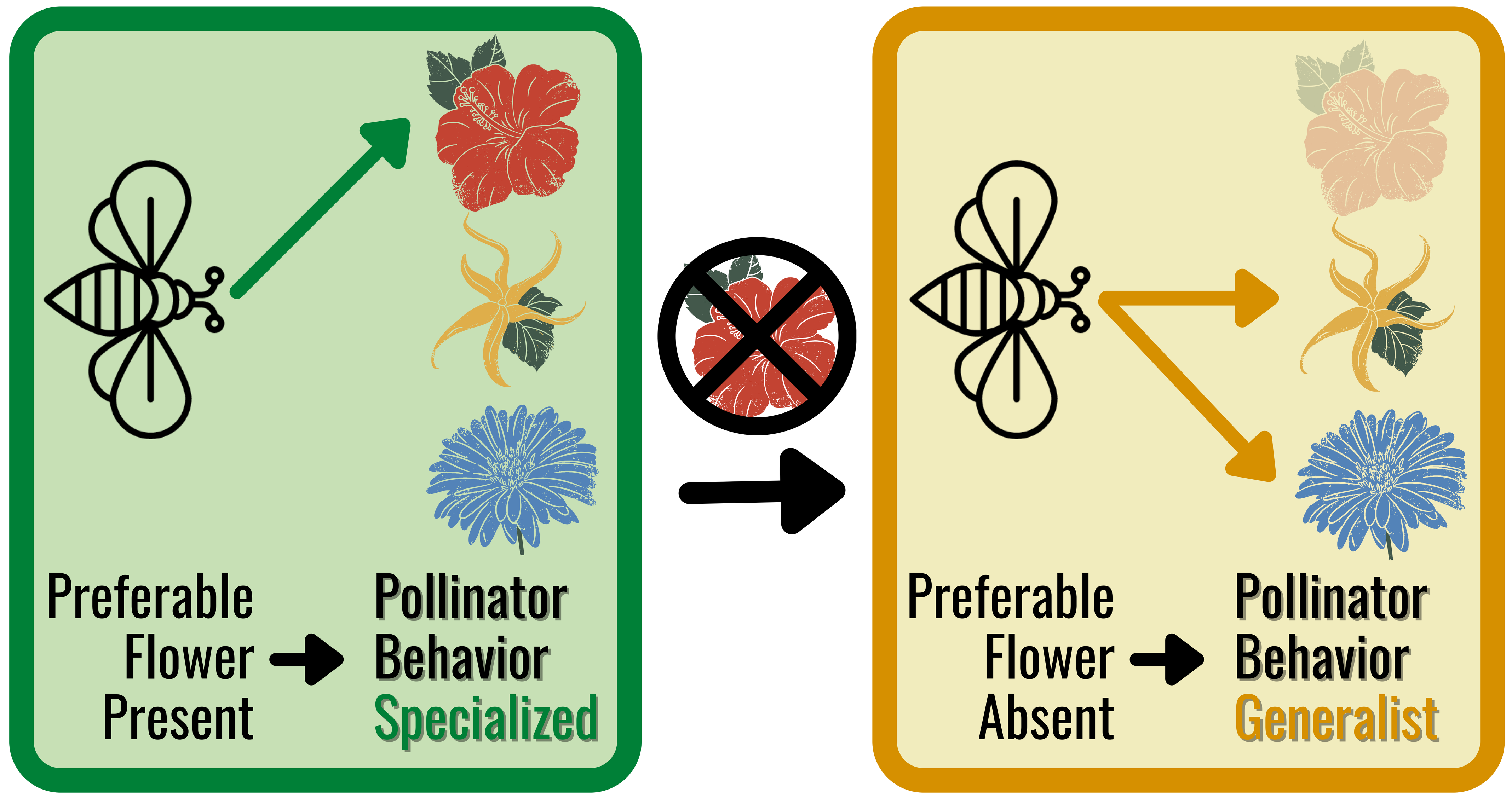
Is this a Pollination Syndrome?

Not quite! Pollination Syndromes presume a coevolutionary history which has not been proven. Corbet's analysis divides plants and pollinators into 3 functional categories based on observed interactions:

Allophilous Plants	small flowers, accessible nectar
Hemiphilous Plants	partially concealed nectar
Euphilous Plants	fully concealed nectar, often bell-shaped

What are Null Models?

Null models provide a baseline for comparison by creating a randomly structured network with the same size and number of interactions as the observed network. This baseline can be used to establish whether a network feature is the product of an ecological process or simply a product of sampling effort.



Results

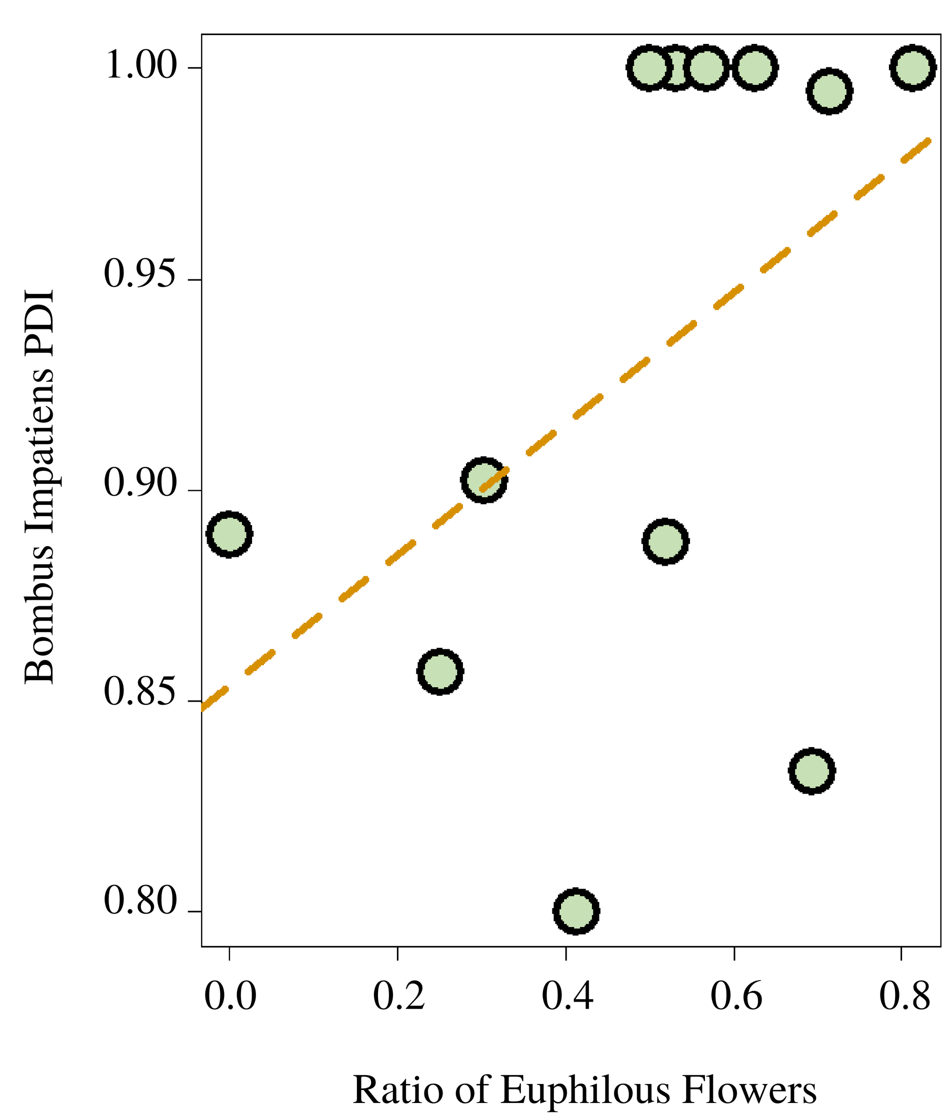


Figure 1: Scatterplot of linear model for *Bombus Impatiens* with R2 = 0.2641 implying low correlation between ratio of well-suited flowers and PDI; indicative of results for all study species

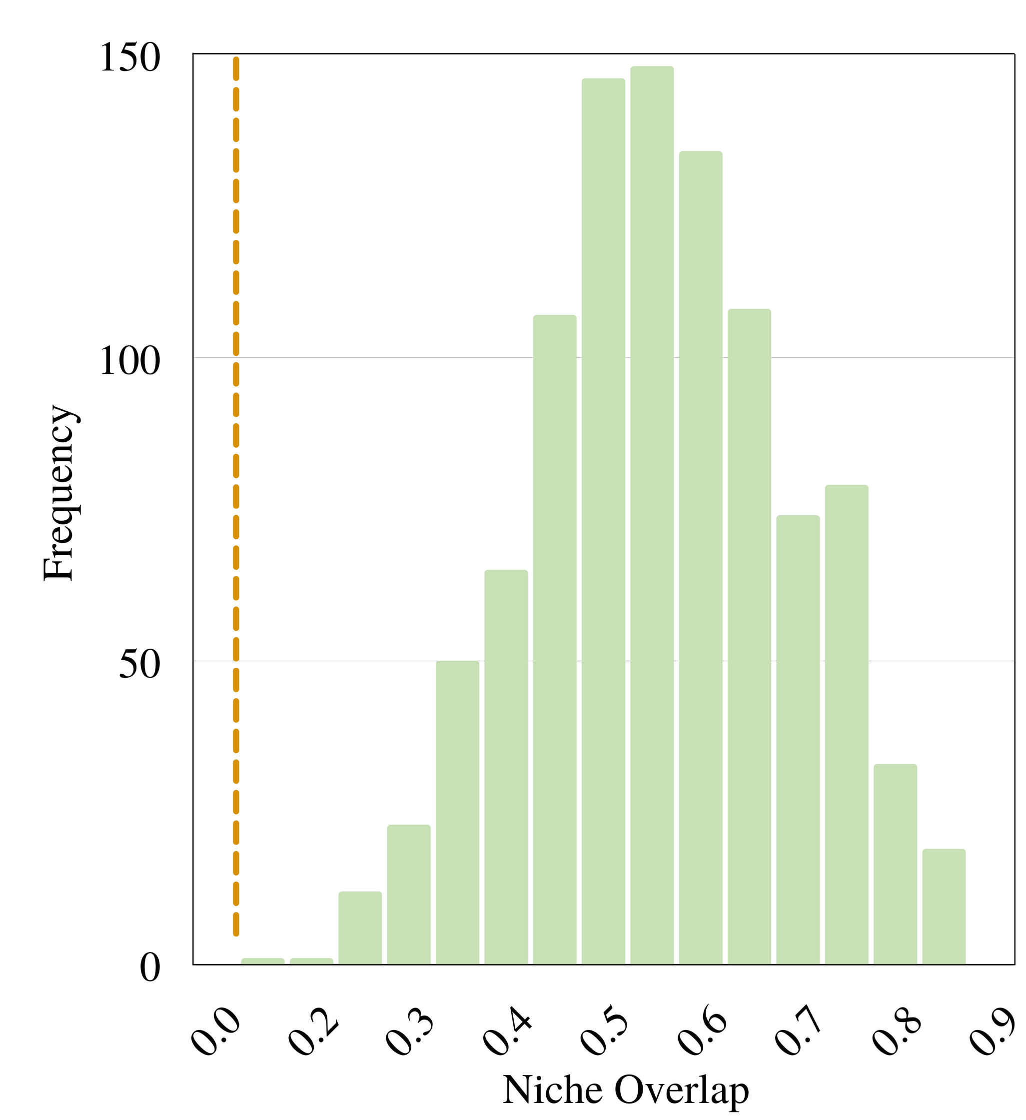


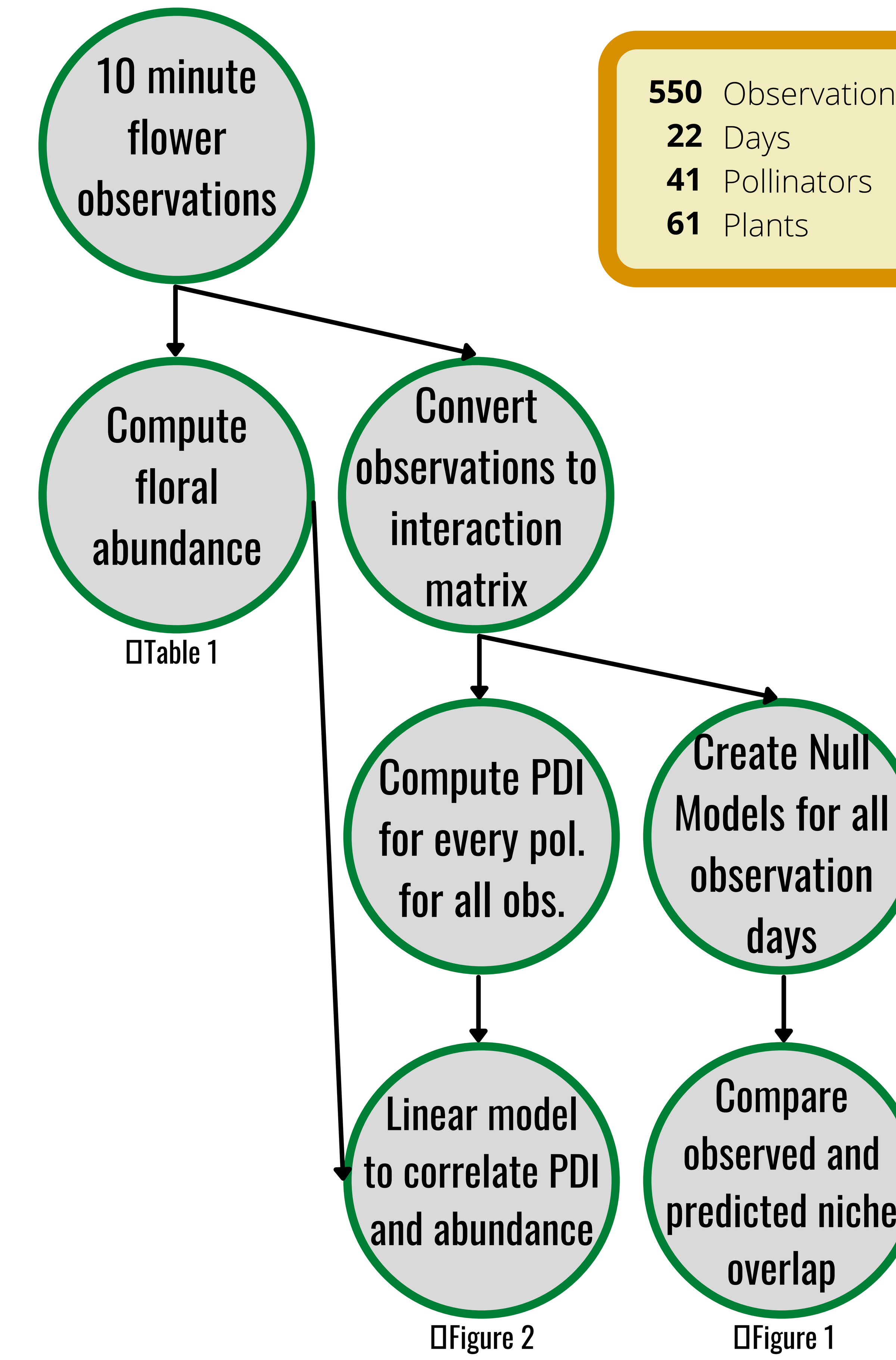
Figure 2: Indicative histogram of Niche Overlap (NO) computed from 500 null models (green) and observed value (orange) for June 9th. For all null models, z-scores > 3 strongly suggest observed NO not random.

Table 1: Relative abundance of each flower type on each observation day

	7 May	29 May	31 May	9 June	15 June	30 June	11 July	13 July	21 July	30 July	13 Aug.	29 Aug.	4 Sep.	16 Sep.	21 Sep.	7 Oct.	13 Oct.
Allophilous	0.048	0.99	0.67	0.68	0.43	0.53	0.81	0.63	0.57	0.69	0.71	0.41	0.30	0.0	0.52	0.25	0.5
Hemiphilous	0.0	0.0010	0.33	0.32	0.52	0.47	0.047	0.0	0.0	0.0	0.062	0.037	0.091	0.0	0.065	0.0	0.0
Euphilous	0.95	0.0	0.0	0.0	0.043	0.0	0.14	0.38	0.43	0.31	0.22	0.55	0.61	1.0	0.42	0.75	0.5

Methods

550 Observations
22 Days
41 Pollinators
61 Plants



Conclusions

- Ratio of well-suiting flowers did not strongly predict PDI for any species
- Comparing niche overlap (NO) to null models reveals this variable is strongly non-random

Confounding Factors

- Most days, most pollinators were only observed on one flower leading to very skewed PDI Values

Restoration Considerations

- Restoration plantings should include a range of flower typologies throughout the year

Works Cited

1 - *Vázquez, D. P., et al., N. P. Uniting pattern and process in plant–animal mutualistic networks: a review. Annals of Botany 103, 1445–1457 (2009).*

2 - *e.g. novel work like Bramon Mora, B.,et al., Untangling the seasonal dynamics of plant pollinator communities. Nat Commun 11, 4086 (2020).*

3 - *Ellis, W. N. & Ellis-Adam, A. C. To make a meadow it takes a clover and a bee: the entomophilous flora of N.W. Europe and its insects. BTD 63,193–220 (1993).*

4 - *Corbet, S. A Typology of Pollination Systems: Implications for Crop management and the Conservation of Wild Plants (2007)*

5 - *Dormann, C. F. Using bipartite to describe and plot two-mode networks in R. 28.*

Acknowledgements

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