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Are flies pollen their weight?

Data mining social media for information on fly (Diptera) pollinators

INTRODUCTION

Global concern regarding pollinator decline has intensified interest in understanding pollinator ecology and managing pollinator supportive landscapes. Providing floral habitats that favor pollinators will strongly influence pollination services provided in both natural and agricultural settings (Blaauw & Isaacs 2014, *J Appl Ecol* **51**: 890). Therefore, development of landscape management practices and conservation tools should support a wide variety of pollinators. Recent attention however, has focused largely on bees, butterflies, and vertebrate pollinators. With the exception of bee flies (Family Syrphidae), alternative fly pollinators within the Order Diptera may also be important pollinators based on abundance and strong attraction to flowers for foraging, carbohydrates (nectar) and protein (pollen) (Brodie et al. 2016, *PloS ONE* **10**: e0145055). However, their contributions as pollinators and pollination ecology is poorly understood and often overlooked.

Citizen science may be a tool to help identify the occurrence and the relationship between flies and flowers, and accelerate the search of fly pollinator-attractive plants. By 'passively' crowdsourcing data from hundreds of images posted on social media resources from all over the world, we hypothesized that the abundance of Internet images of flowers with visiting flies may correspond to their 1) potential value as pollinators, 2) attraction to visual floral characteristics, and 3) taxonomic diversity.

METHODS

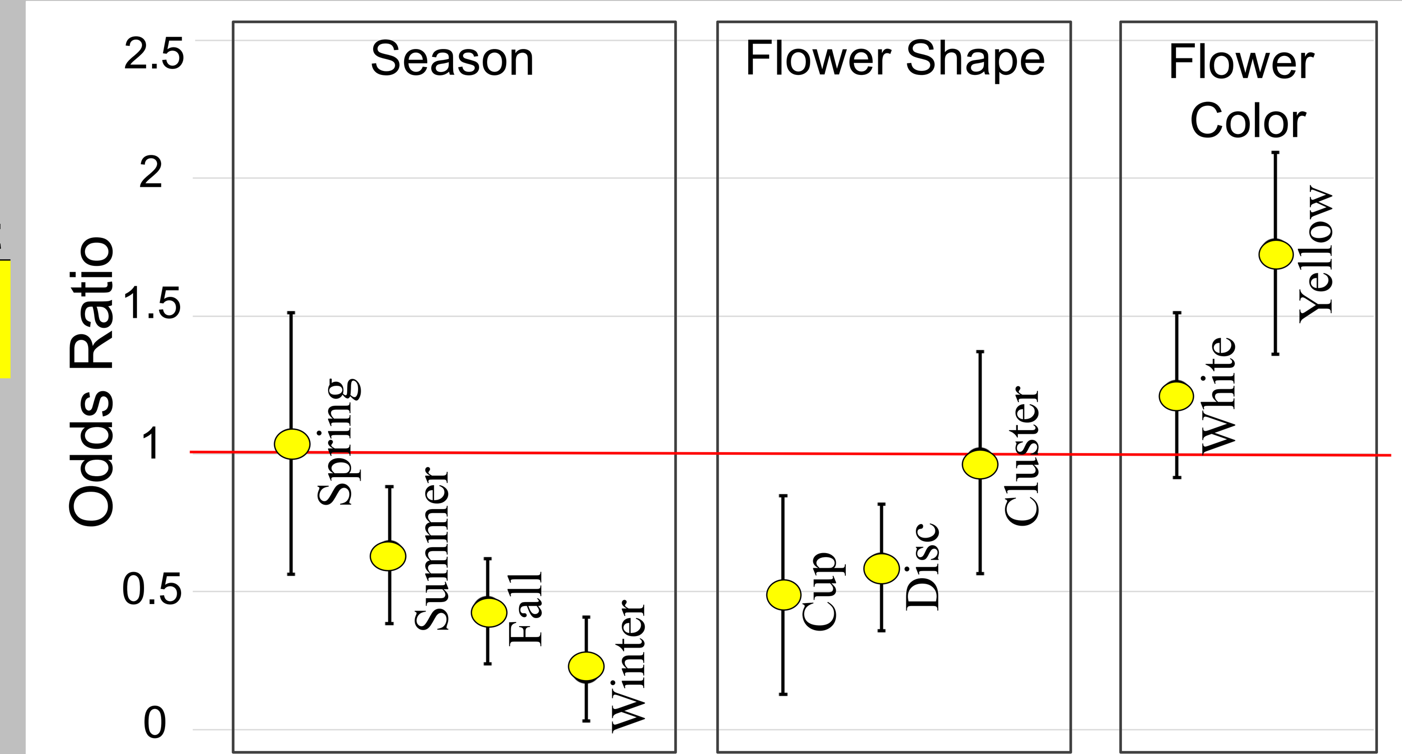
To determine the frequency of occurrence of fly pollinators on flowers, combinations of key word searches in Google Image Search or various social media photo sharing applications (e.g. Flickr, Instagram, Facebook, Twitter, etc.). Photos were sequentially evaluated and taxonomical information recorded for fly (family) and flower (species). Additionally, flowers were categorized by color and shape, and flies sex was determined as well as presence and absence of pollen, and active feeding (mouthparts extended). Data was analyzed using logistic regression to predict the probability of flies feeding and carrying pollen as a function of flower variables, such as color, shape, and season.

Photo: Michael Hrabar

RESULTS

1) POLLINATORS: Model selection table for models predicting the probability of flies carrying pollen

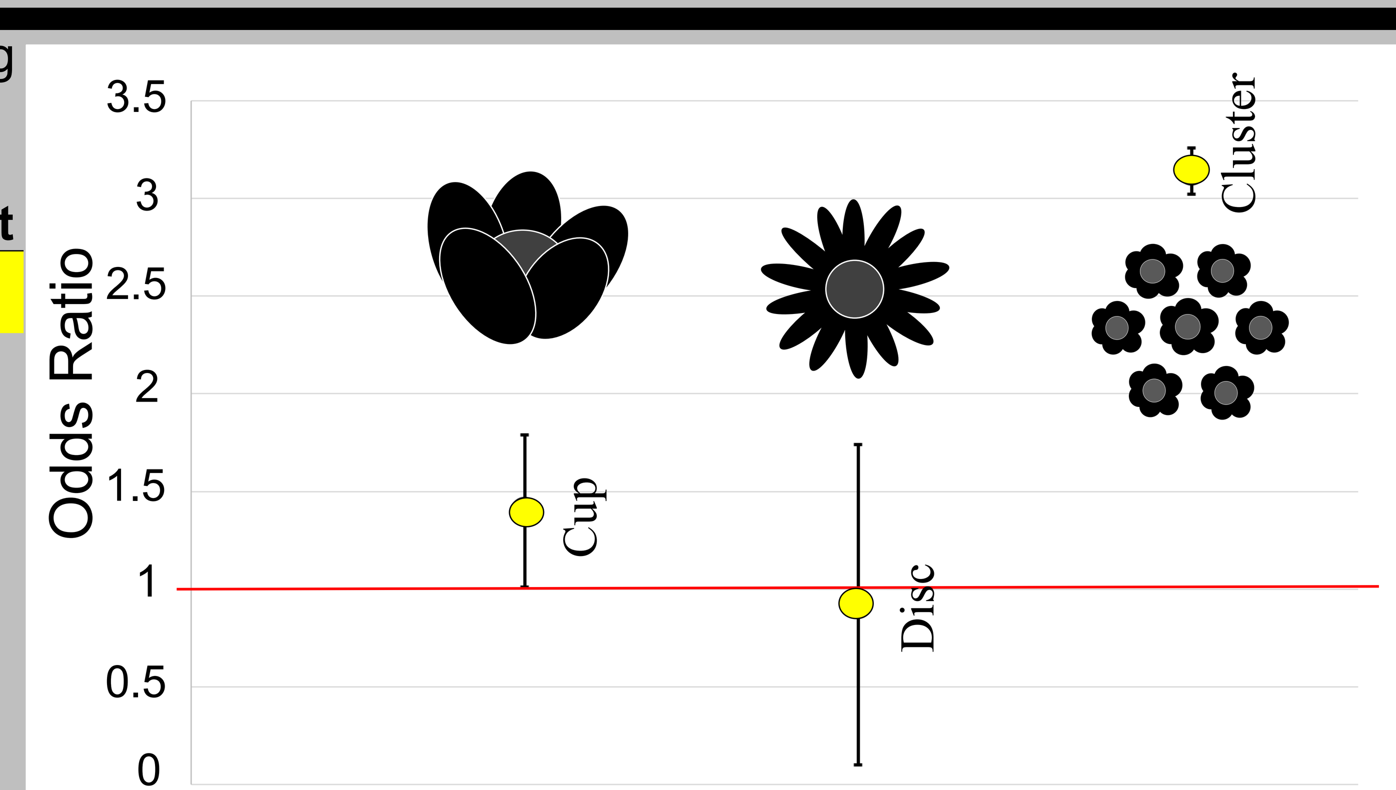
Model	No. Parameters	LogLik	AICc	Delta AICc	Weight
Flower Shape + Season + Flower Color	9	-398.695	816.2	0	0.39
Flower Shape + Flower Color	5	-403.969	818	1.81	0.16
Season + Flower Color	7	-402.075	818.3	2.11	0.14
Flower Color	3	-406.309	818.7	2.43	0.12
Flower Shape + Season	7	-402.565	819.3	3.09	0.08
Season	5	-405.088	820.3	4.05	0.05
Flower Shape	3	-407.67	821.4	5.15	0.03
Flower Shape x Season	14	-400.561	829.8	13.6	0



Odds ratios from model flower shape + color + season (BEST Model).

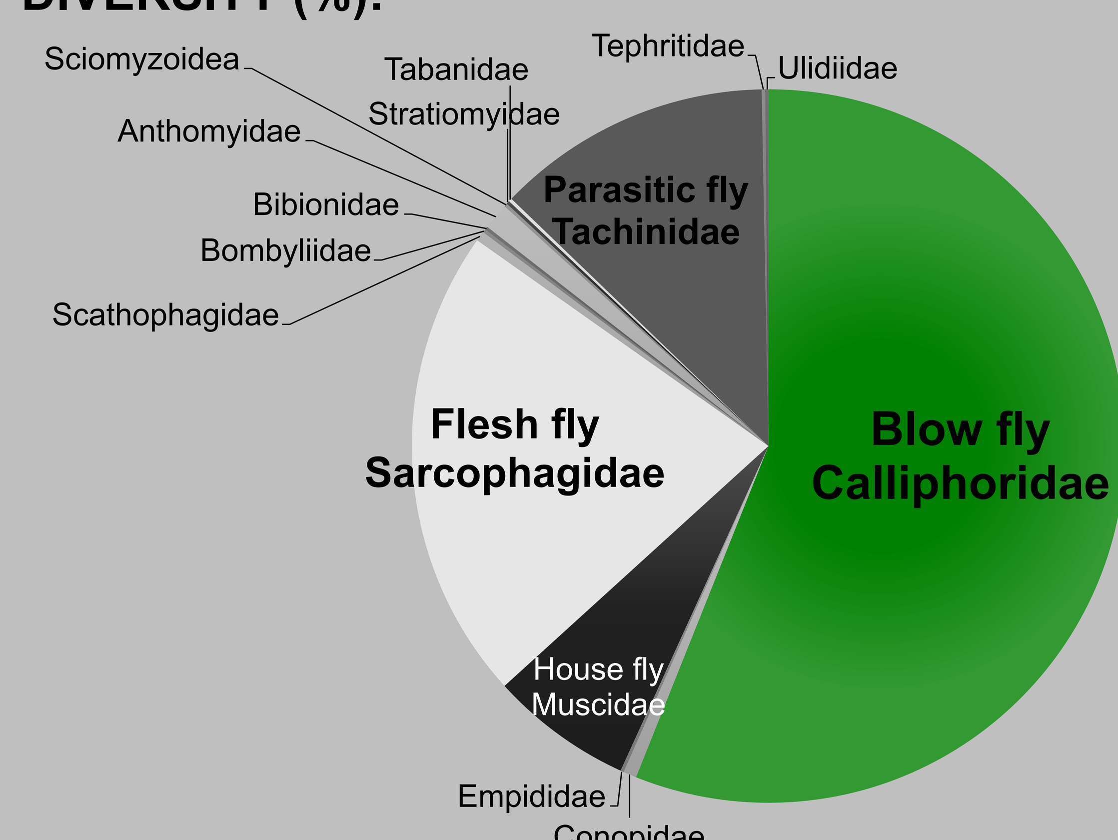
2) FLORAL PREFERENCES: Model selection table for models predicting the probability of flies actively foraging on flowers

Model	No. Parameters	LogLik	AICc	Delta AICc	Weight
Flower Shape	3	-371125	748.3.3	0	0.71
Flower Shape + Flower Color	5	-370.159	750.4	2.13	0.24
Flower Shape + Season	7	-370.619	755.4	7.14	0.02
Flower Shape + Flower Color + Season	9	-369.509	757.3	9.03	0
Flower Shape x Season	14	-367.151	763	14.72	0
Flower Color	3	-387.491	779.0	30.73	0
Flower Color + Season	7	-385.148	794.5	36.19	0
Season	5	-394.073	798.2	49.96	0



Odds ratios from model flower shape (BEST Model).

3) FLY DIVERSITY (%):



n = X images

FUTURE WORK

We will increase the scope of our project to include ALL navtive pollinators and continue to add fly images to the data collection by interacting with citizen scientists and requesting images - 'actively' crowdsourcing. Field trials will be implemented to compare the results of online searches and confirm fly-flower interactions captured in images.

CONCLUSIONS

Using model selection, our data indicates 1) fly pollen coverage was strongly associated with yellow flowers (73% increase in the likelihood that flies will be carry pollen when on yellow flowers); presence of pollen on flies was also associated with cluster shaped flowers ,with cup and disc shaped flowers being 51% and 41% less likely to be associated with carrying pollen, respectively. 2) Flies were 300% more likely to be actively feeding on cluster shaped inflorescences, followed by cup-shaped flowers at 140%; flies did not select for or discriminate against disc-shaped flowers . 3) Flower foraging flies were composed of 16 different Families with blow flies (Family Calliphoridae) as the largest representative (x%).

We found evidence that a large number of non-Syrphidae fly Families exploit floral shape as the primary visual cue during foraging and are visiting a variety of flowers while carrying pollen, indicating that flies are playing a significant role as pollinators to a variety of flowers.

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#PhotobombingFlies

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