



VERMONT
BEE LAB

Evidence revealing interactions between honey bees and non-flowering plants

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Introduction

Ferns and mosses lack the co-evolved relationships with animals, such as honey bees, upon which the flowering plants rely for dispersal. Instead, the dispersal of fern and moss spores is thought largely to be passive, with spores landing close to the parent plants and hence limiting dispersal distance and likelihood of outcrossing.

However, we find evidence of interaction between honey bees and ferns and mosses. We hypothesize that bees encounter fern and moss spores in their environment incidentally while foraging for nectar, pollen or water. Our preliminary findings suggest that bees may have a larger role in spore dispersal than previously thought.

BEES & MOSSES

Do honey bees collect moss and fern spores?

Methods

Bee-collected pollen and nectar samples were collected from five apiaries in Vermont from May-September and analyzed for plant genetic composition. Individual pollen loads were evaluated for the presence or absence of fern or moss spores using microscopy.

Key Findings

Moss (family *Bryaceae*) and fern (family *Osmundaceae*) DNA were observed in 12.5% of nectar samples (Fig. 1).

58% of visualized pollen loads were found to contain between 16-83 moss spores and 16-416 fern spores.

Where do honey bees encounter spores?

Methods

To test whether bees encounter spores incidentally while foraging for pollen and nectar from flowering plants, flowers were sampled from sites and analyzed for spore presence using a density gradient method and microscopy.

Key Findings

Fern spores were found on 21% of the floral samples (Fig. 2).

Honeybees were also observed foraging on moss surfaces (Fig. 3).

Are the bee-collected spores viable?

Methods

Individual pollen loads were prepared and pipetted onto Knops media plates. Plates were maintained until germination was observed.

Key Findings

Bryaceae spp. spores successfully germinated from 33% of samples (Fig. 4).

Discussion & Future Research

Our findings suggest that bees likely encounter spores while foraging for nectar and pollen on floral surfaces. Honey bees may also encounter spores while collecting water at spore-contaminated waterways or directly from *Bryaceae* spp. due to the moss' high water-holding capacity. However, it is yet to be determined whether these encounters are solely incidental or if bees seek spores as a source of nutrition.

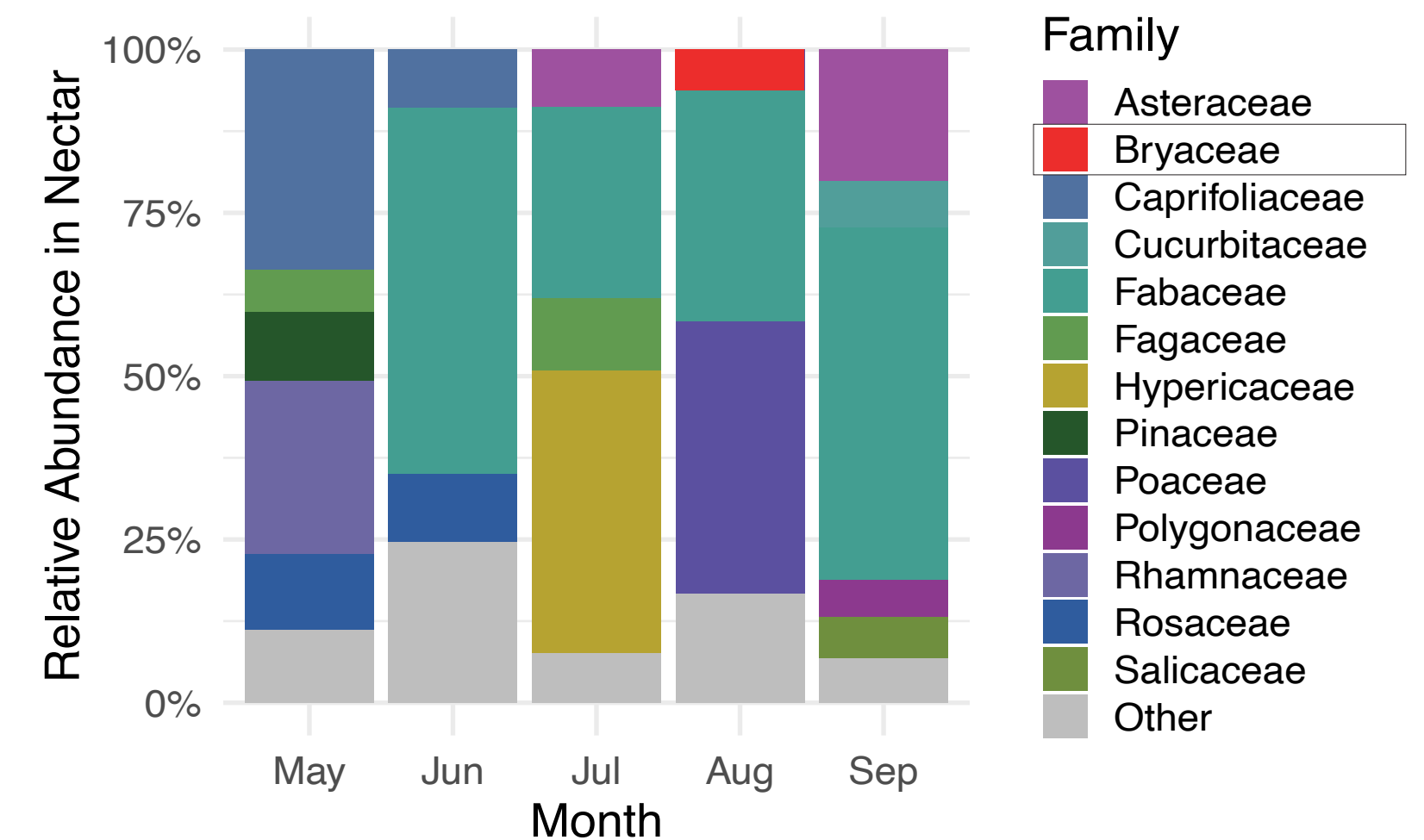


Fig. 1 The relative abundance of plant DNA in nectar samples taken from one site from May-September. The plant composition in August reveals *Bryaceae* spp. DNA.



Fig. 2 An *Osmundaceae* spp. spore and pollen grains from a flower head.



Fig. 3 A honey bee observed foraging on *Bryaceae* spp.

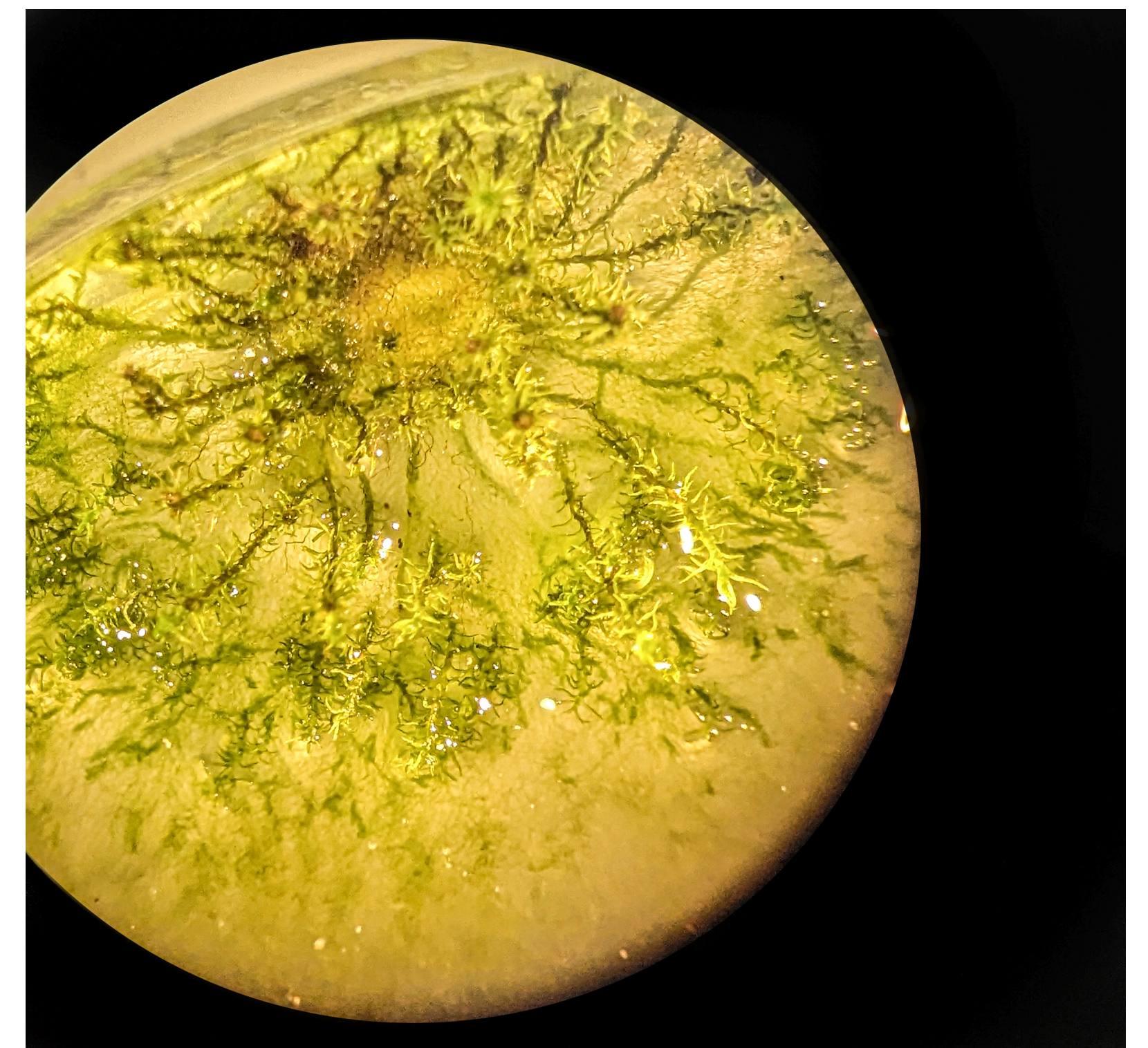


Fig. 4 *Bryaceae* spp. germinating from a plated pollen load.

We have evidence to suggest that even the occasional, passive dispersal of spores may have implications for the distribution of mosses and ferns. Our findings reveal a biological interaction between honey bees and non-flowering plants which calls for future research.