Project title: How do pesticides and extreme climate events influence bumblebee cognition

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Project keywords: Pollinators, climate change, pesticides, bees, conservation, ecology, behaviour

Proposed start date: 3rd of June (but flexible depending on applicant availability).

Project description: Bumblebees forage in a complex, ever changing floral marketplace. They have to learn to find rewarding flowers, and extract nectar and pollen efficiently in order to be beneficial to their colony. Unsurprisingly, bees have evolved a sophisticated level of cognition, and are a model species for studying insect learning and memory. However, in a anthropized world, bumblebees are being increasingly exposed to a plethora of abiotic and biotic stressors, such as pesticides and extreme climate events (e.g. heat waves)[1]. These stressors can directly influence bumblebee mortality, but can also have more subtle, sub lethal impacts on animal behaviour and cognition[2,3]. Furthermore, these stressors do not act in isolation, but interact, which may exacerbate their individual impact[4]. Here, we will investigate how exposure to a novel pesticide influences bumblebee learning and memory under both ambient or extreme foraging environments. The aim is to understand how resilient bumblebee cognition is in the face of anthropogenic stressors which are increasingly present in their environment.

Candidate requirements: We seek an enthusiastic, highly motivated student with a broad interest in animal behaviour, cognition, ecology, and conservation. You do not need to have a background in these disciplines but an eagerness to learn about one, or more of these topics is essential.

Background reading:

1. Goulson, D., Nicholls, E., Botias, C. & Rotheray, E. L. Bee declines driven by combined stress from parasites, pesticides, and lack of flowers. *Science (80).* **347**, 1255957 (2015).
2. Siviter, H., Richman, S. K. & Muth, F. Field-realistic neonicotinoid exposure has sub-lethal effects on non-*Apis* bees: A meta-analysis. *Ecol. Lett.* **24**, 2586–2597 (2021).
3. Siviter, H., Koricheva, J., Brown, M. J. F. & Leadbeater, E. Quantifying the impact of pesticides on learning and memory in bees. *J. Appl. Ecol.* **55**, 2812–2821 (2018).
4. Siviter, H. *et al.* Agrochemicals interact synergistically to increase bee mortality. *Nature* **596**, 389–392 (2021).

Approximate Work Schedule in weeks (desk based/lab/report writing)

Week 1- Project planning, student training (with PI) and literature review. (Desk and lab based). Weeks 2-6 – Data collection in the lab. (Lab based). Weeks 7-8 – Date analysis and write up. (Desk based).