

The Effect of Anthropogenic Activities on the Pollination of Wildflowers



By: Kathlyn Feeney; Paul Hamilton (Supervisor)
Faculty of Science, Department of Environmental Science, ATU Sligo

Background and Objectives:

For this study the effect that anthropogenic air pollutants have on wildflower pollen quality was examined. As previous studies show, air pollutants can restrict the pollination process by altering pollen grains and decreasing viability and germination (1). Successful pollination and viable pollen are important as they are needed for sexual reproduction in many plants. Pollen is also a food source for many insect species, especially bees, who use it as their main source of energy.

Objectives:

- Collect a wildflower(s) sample whose pollen can be used for microscopic observation.
- To prepare the pollen sample(s) for microscopic investigation.
- To view the pollen sample(s) under a microscope, which can be compared to other pollen samples found on online databases.
- To contact Sligo County Council for air monitoring data which together with my pollen sample and previous studies, can be used to determine if there is a correlation between air pollutant levels and pollen quality.

Methodology:

Sample Collection: Samples were collected from 3 sites in Co. Sligo (Fig 1).

Sample Preparation and Observation: Samples were dried for 24hrs before being treated with glycerine and viewed under a light microscope.

Pollen Cell Calculation: First the field of view (FOV) of the microscope was measured. The FOV was then divided by the number of cells which fit across the view of the microscope. This then gave the size for each individual cell in micrometres.

Results:

Table 1: The Measured Annual Mean, EU Legal Limit and WHO Guideline for Pollutants Nitrogen Dioxide, Particulate Matter 10 and Particulate Matter 2.5.

Pollutant:	Annual Mean (µg/m³):	EU Legal Limits (µg/m³):	WHO Guidelines (µg/m³):
Nitrogen Dioxide	35.3	40	10
Particulate Matter 10	18.3	40	15
Particulate Matter 2.5	12.9	25	5



Figure 2: From Left to Right- Crepis capillaris (Smooth Hawk's-beard) at Collection, at x100 Magnification and at x100 Magnification from PalDat (2).

Table 2: The Measured Pollen Grain Size of Each Species Observed Compared to PalDat's Average Pollen Grain Size for That Species.

Species Name	Measured Pollen Size (µm)	PalDat Average Pollen Size (µm)
<i>Geranium Robertianum</i> (Herb Robert)	53	50-100
<i>Centranthus ruber</i> (Red Valerian)	39.75	51-100
<i>Hedera Helix</i> (Common Ivy)	15.9	26-30
<i>Crepis capillaris</i> (Smooth Hawk's-beard)	19.9	26-30
<i>Ulex europaeus</i> (Gorse)	26.5	26-30
<i>Ranunculus acris</i> (Meadow Buttercup)	22.7	36-40
<i>Sinapis arvensis</i> (Charlock)	24.5	31-35
<i>Angelica sylvestris</i> (Wild Angelica)	31.8	26-30

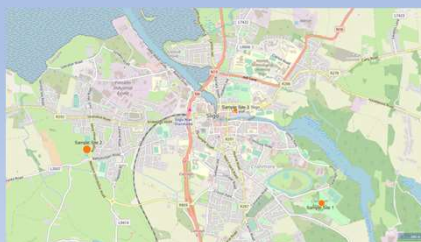


Figure 1: Locations of Sampling Points.

Discussion:

A total of 8 wildflower species were collected from the sampling points, shown in figure 1. The use of a variety of wildflower species gave insight into how pollutants may impact each species. The lack of air quality data available for Co. Sligo for 2022 limited the study. Although, the 2021 data for Sligo showed that there were exceedances of EU legal limits and WHO guidelines, as seen in table 1 and figures 3+4.

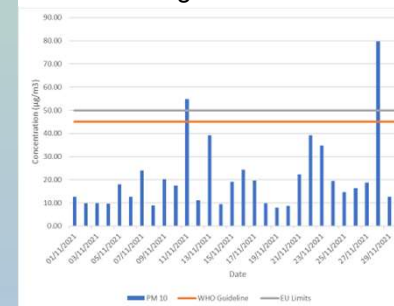


Figure 3: Sligo's Daily pm10 conc. Nov 2021.

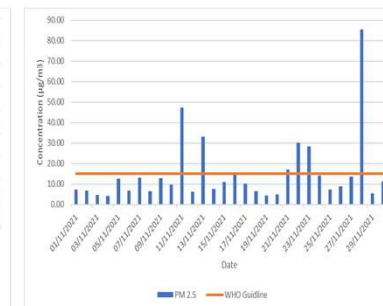


Figure 4: Sligo's Daily pm2.5 conc. Nov 2021

WHO guidelines for health are not currently legally binding though the EPA mentions in their latest air quality report that the country should aim to achieve them (3). Table 2 showed there were some differences in pollen size observed when compared to online databases, although it could not be said for definite if air pollutants were the only factor which altered the pollen's shape/size. Despite this study not showing a clear correlation between pollen quality and air pollutant levels, it did highlight the importance of pollination and pollen quality for our ecosystem. The study also showed the lack of air quality monitoring in Sligo, which should be carried out to identify if there are any risks to human health or our ecosystem.

References:

1. Cuinica, *et al* (2014).
2. Auer (2020).
3. EPA (2021).

Conclusion:

Literature research did show that air pollutants can impact pollination by altering pollen grains, which decreases viability and germination. For future studies, a control sample would be useful or exposing pollen samples to pollutants *in-vitro* to exclude any other factors which may influence the pollen quality. The study also highlighted the need for an air monitoring station in Co. Sligo.