2.1.1

The structure of the seed of dandelions enabled themselves to spread in great efficiency and help the colonies of dandelions to thrive. The most representative characteristic of the dandelions is the pappus on the top of its see. Using long-exposure photography and high-speed imaging, the researchers discovered that a kind of stable air bubble known as a vortex ring remained a fixed distance from the seeds. Experiments that imitated the aerodynamics of a dandelion pappus suggested the circular geometry and airy nature of the pappus is tuned precisely to stabilize these vortex rings, helping them deliver four times more drag than a solid disk with the same area (Cummins et al., 2018). Furthermore, a single dandelion could produce up to 150 seed heads per year that each produces 250 seeds (Stewart-Wade et al., 2002b). With such advanced seed structure made for spreading and such a large scale of seed production, dandelion seeds seem to be destined to disperse in a large scale.

However, a 2003 study at the University of Regensburg in Germany found that 99.5 per cent of dandelion seeds land within 10 meters of their parent. That’s because the seed falls at about 30cm per second and dandelions only grow about 30cm high. Each seed could merely travel one second before it lands. (Villazon, n.d.-b). The overwhelming majority of seedlings come from recently dispersed seeds (Hacault & Van Acker 2006).  In one experiment, a majority of seeds were consumed by ground beetles within 2 to 3 weeks after shedding, but the 2-4% of viable seeds that remained were sufficient to maintain high soil populations (Honek et al. 2005). However, it is these factors that balanced the population size and spread of the species.

Different conditions greatly affect the distance of dandelion’s seed dispersal. Among all factors, climate factors, including humidity; wind intensity; air temperature affects the long-distance dispersal of dandelion seeds. According to Tackenberg et al. (2003), long-distance dispersal of seeds of herbaceous species with falling velocities < 0.5 - 1.0 ms-1 is mainly caused by convective updrafts. The greater these updrafts are, the further are dandelion seeds dispersed. In addition, (Kuparinen et al., 2009) found that the amount of long-distance dispersed seeds generally increased under the scenario of +3℃ warming. Furthermore, according to Seale et al. (2019), by changing the shape of the pappus when wet, detachment from the parent plant is greatly reduced and seed falling velocities are increased with a significant change in velocity deficit behind the seed. We suggest that this may be a form of informed dispersal maintaining LDD in dry conditions, while spatiotemporally directing short-range dispersal toward beneficial wetter environments.

2.2.1

They play a crucial role in the reproduction of many plant species by providing a source of nectar and pollen for bees and other pollinating insects, especially during the early spring when few other plants are in bloom (Dock, 2023) (Leong, 2023). They are as well beneficial in facilitating healthy soil. They are able to restore soil mineral content. This in turn produces more nutrient dense fruits, vegetables, and other crops. This is especially important in areas where soil has been degraded of essential minerals from industrial farming practices (De Jong Meg De Jong Nutrition, 2019).

However, the presence of dandelions might be extremely detrimental to the local ecosystem when it becomes an invasive species.  When native dandelions are mixed with attractive invasives, natives may suffer from reduced seed set because invasives deprive natives of pollinators or because pollinators frequently move between species, resulting in interspecific pollen transfer (Kandori et al., 2009).

Reference list:

Cummins, C., Seale, M., Macente, A., Certini, D., Mastropaolo, E., Viola, I. M., & Nakayama, N. (2018). A separated vortex ring underlies the flight of the dandelion. *Nature*, *562*(7727), 414–418. <https://doi.org/10.1038/s41586-018-0604-2>

De Jong Meg De Jong Nutrition, M. (2019, May 21). *Dandelion benefits biodiversity, soil and your health – Mother Earth News*. Mother Earth News – the Original Guide to Living Wisely. <https://www.motherearthnews.com/natural-health/dandelion-benefits-biodiversity-and-health-zbcz1905/>

Dock, A. (2023, April 30). *Dandelion*. BritishLocalFood. <https://britishlocalfood.com/dandelion/>

Hacault, K. M., & Van Acker, R. C. (2006). Emergence timing and control of dandelion (*Taraxacum officinale*) in spring wheat. *Weed Science*, *54*(1), 172–181. <https://doi.org/10.1614/ws-05-083r.1>

Honěk, A., Martinková, Z., & Saska, P. (2005). Post-dispersal predation of Taraxacum officinale (dandelion) seed. *Journal of Ecology*, *93*(2), 345–352. <https://doi.org/10.1111/j.1365-2745.2005.00987.x>

Honěk, A., Martinková, Z., Saska, P., & Koprdová, S. (2009b). Role of post-dispersal seed and seedling predation in establishment of dandelion (Taraxacum agg.) plants. *Agriculture, Ecosystems & Environment*, *134*(1–2), 126–135. <https://doi.org/10.1016/j.agee.2009.06.001>

Kandori, I., Hirao, T., Matsunaga, S., & Kurosaki, T. (2009). An invasive dandelion unilaterally reduces the reproduction of a native congener through competition for pollination. *Oecologia*, *159*(3), 559–569. <https://doi.org/10.1007/s00442-008-1250-4>

Kuparinen, A., Katul, G. G., Nathan, R., & Schurr, F. M. (2009). Increases in air temperature can promote wind-driven dispersal and spread of plants. *Proceedings of the Royal Society B: Biological Sciences*, *276*(1670), 3081–3087. <https://doi.org/10.1098/rspb.2009.0693>

Leong, M. (2023, April 25). *The benefits of dandelions: How these weeds help our environment*. ShunCy. <https://shuncy.com/article/are-dandelions-good-for-the-environment>

Seale, M., Zhdanov, O., Cummins, C., Kroll, E., Blatt, M. R., Zare‐Behtash, H., Busse, A., Mastropaolo, E., Viola, I. M., & Nakayama, N. (2019). Moisture‐Dependent morphing tunes the dispersal of dandelion diaspores. *Social Science Research Network*. <https://doi.org/10.2139/ssrn.3334428>

Stewart-Wade, S. M., Neumann, S., Collins, L., & Boland, G. J. (2002a). The biology of Canadian weeds. 117. *Taraxacum officinale* G. H. Weber ex Wiggers. *Canadian Journal of Plant Science*, *82*(4), 825–853. <https://doi.org/10.4141/p01-010>

Tackenberg, O., Poschlod, P., & Kahmen, S. (2003). Dandelion Seed Dispersal: The Horizontal Wind Speed Does Not Matter for Long-Distance Dispersal - it is Updraft! *Plant Biology*, *5*(5), 451–454. <https://doi.org/10.1055/s-2003-44789>

Villazon, L. (n.d.-b). *How far can dandelion seeds travel?* BBC Science Focus Magazine. <https://www.sciencefocus.com/nature/how-far-can-dandelion-seeds-travel>