Spatial Flowering Patterns in *Dactylis glomerata* Populations

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Background

Understanding spatial patterns is essential in all ecological research fields[1]. This is especially true in aerobiology, where the spatial patterns of plant source distribution, pollen release and human immunology are inherently interlinked through atmospheric transport[2]. Natural variation in the flowering process of plants produces uncertainties in the timing of pollen release[3]. This uncertainty can be minimized by including both spatial and temporal aspects of population dynamics[45]. We have investigated the detailed flowering pattern within the grass species *Dactylis glomerata* in several populations to account for natural population variation present within the species.

Methods

Eight *Dactylis glomerata* populations were investigated in 2018 for demographic variation in the flowering progression **(Fig. 1.)**. The populations were chosen to include minimum 150 individual tillers and away from road verges. The flowering progression was investigated using the BBCH-scale[6] with focus on the extrusion of anthers from each tiller. Each tiller was assigned **P0** (pre-flowering) until first visible anther. Each tiller was then assigned **P1** to **P4** based on fractions of extruded anthers in the intervals of 25% (i.e. 0 to 25%, 26 to 50% etc.). The full flowering phase (75% to 100%) was actualized as **P4**. Each tiller was assigned **P5** (end of flowering) when the last anther was detached.

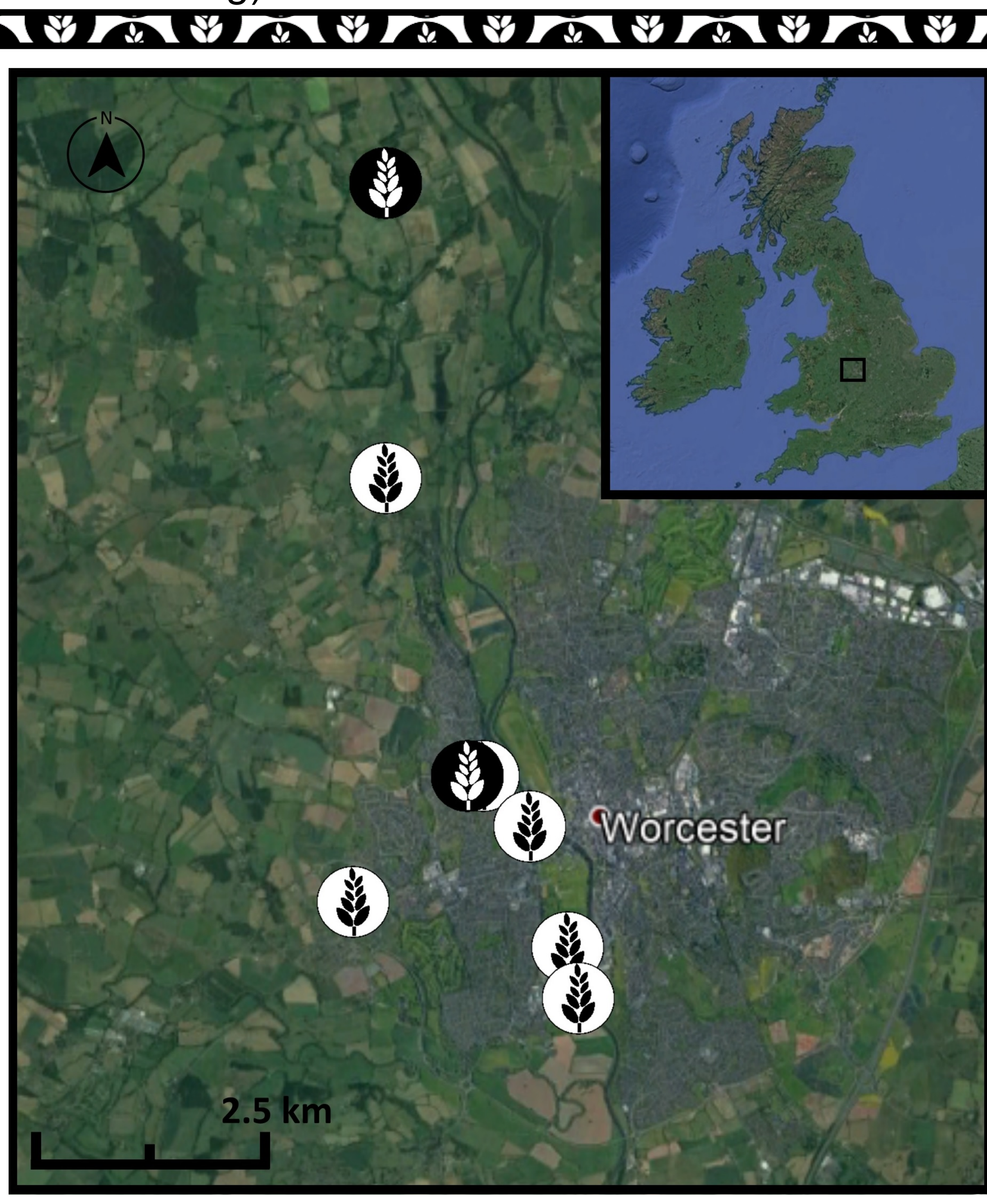

Fig. 1. Map over the Worcester region in the UK[7]. Primary populations are in black and secondary in white.

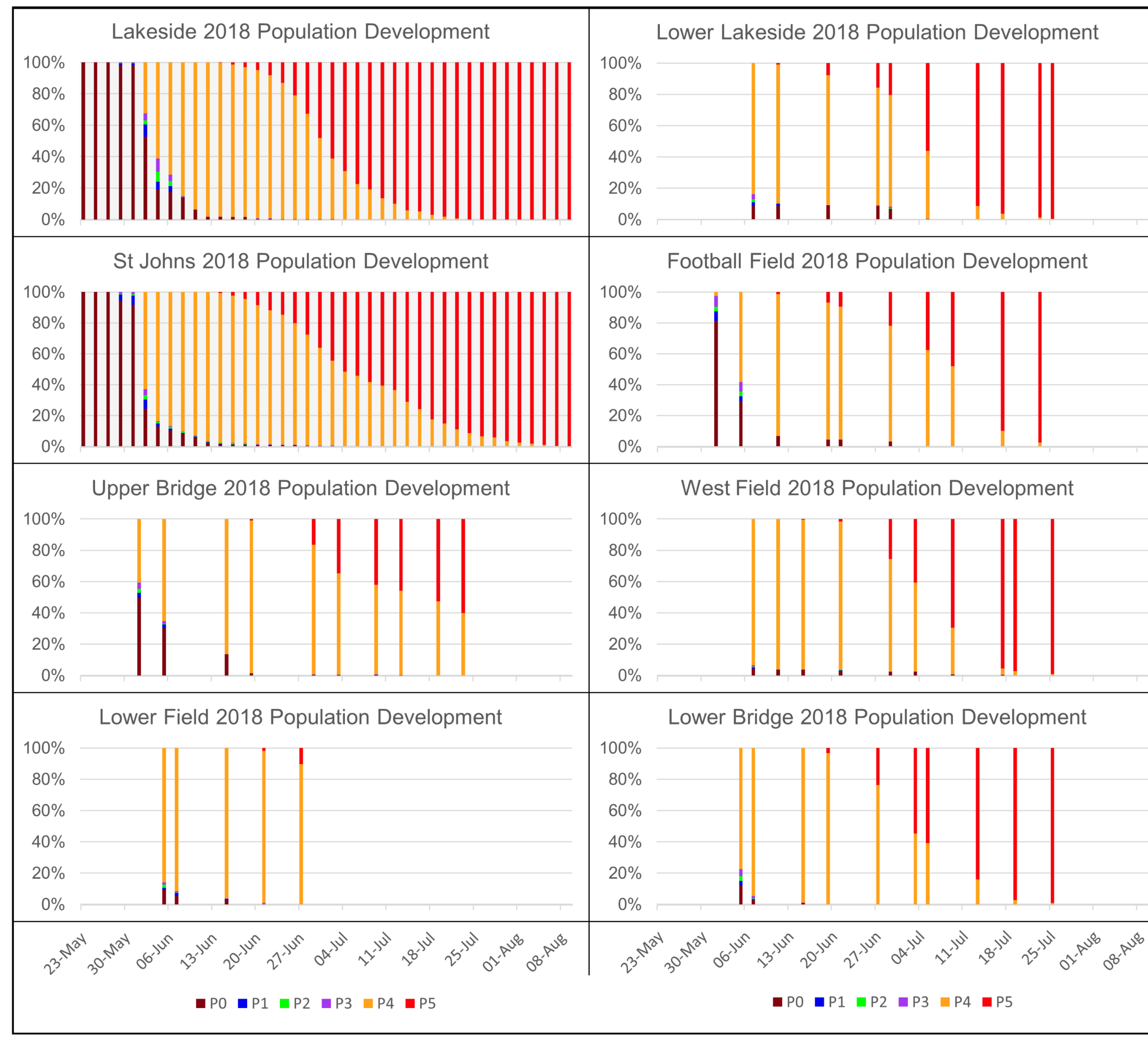

Fig. 2. Flowering development of *Dactylis glomerata* populations in Worcester in 2018. Populations are ordered from North to South (and left to right) as shown in Figure 1.

Results

More than 2500 individual *Dactylis glomerata* tillers were observed during the course of the grass flowering season in 2018, resulting in more than 45.000 individual flowering observations. The two primary populations were visited every second day, starting the 27th of May and ending on the 9th of August. The six secondary populations were visited ten times over the course of the season (except for one population). First flowering was observed in the end of May (29th of May) within both the two primary populations **(Fig. 2.)**. All populations then quickly matured, with many tillers (60 – 80 %) reaching full flowering in **P4** in the beginning of June (6th of June). Maximum number of tillers in full flowering, peak flowering, were reached around the middle of June (14th of June). At the same time the first tiller was seen entering senescence in **P5** while some tillers had yet to start flowering. From this point onward all populations slowly declined into senescence with varying rates. The last tiller reached senescence in the beginning of August (9th of August). No difference in the general flowering progression rate can be observed from north/south or west/east.

Discussion and Conclusion

The detailed spatial approach to flowering progression highlights that all *Dactylis glomerata* populations progress uniformly throughout an entire region. Critical flowering events such as start of flowering, full flowering and peak flowering all coincide between populations. The population approach showcases the demographic process shared both within and between flowering populations, which is visible through the overarching developmental progression similarities and shared phase distribution patterns. Increased understanding of spatial flowering patterns of this widespread highly allergenic pollen-producer will likely shed new light on conditions relevant to grass pollen release modelling and forecasting.

References

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