Optimization of *Taraxacum* Distribution in a Uniquely Urban Environment

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Abstract

Methods of plant maintenance and dispersal are here presented, with the goal being to better understand niche occupation and dominance by *Taraxacum* species in an urban setting. Application of multiple, non-overlapping tactics are shown to generate substantial performance, likely superior to any single method alone. The suggestion is made that enhanced fecundity can be achieved for *Taraxacum* populations in urban environments via targeted approaches.

Keywords: Cultivation; Dispersal; Watering; Statistics

Introduction

Despite considerable regulatory efforts, *Taraxacum officinale* enjoys widespread spatial and seasonal niche occupation. There is nevertheless little information available on specific mechanisms utilized by cultivars for optimization of *T. officinale* distribution, particularly for urban environments [1]. In this manuscript the results of controlled experiments are presented and analyzed in an effort to bridge this important gap in our horticultural understanding. Building upon work performed previously [2,3] focus is here directed at evaluating methods of population maintenance and seed dispersal.

Methods

Experimentation was performed from April – October, 2014, and was restricted to a specific cultivation zone (henceforth termed “yard”) in the city of Geneva, in the state of New York (USA). This general region has been defined by local authorities as “uniquely urban” (www.visitevany.com). *Taraxacum officinale* growth and maintenance was evaluated within a controlled environment, operationally defined by the spatiotemporal confines of several independent methodological parameters. Firstly, the yard was watered daily and liberally, including days that experienced substantial natural rainfall. As a control an adjoining, non cultivated area (roadway) was also watered. Watering was performed manually by the author using available equipment; specifically, a water spigot and conventional (i.e., green) garden hose located at the side of the adjoining neighbours’ house (Figure 1a). Later in the experiment this method became unavailable (see Results, and Ontario County Civil Court Records #2014-0445-02), necessitating access to a public water line via fire hydrant (see Results, and Ontario County Criminal Court Records #2014-A-66). To control for potential circadian aspects of *T. officinale* growth and metabolism all watering sessions were performed between 0300-0400 local sidereal time. To minimize risk of injury and inconvenience to neighbours and nearby fauna, each watering session was immediately presaged with three distinctive activations of an audible siren system (Thunderbolt model 1003, Federal Signal Corp., Oak Brook, IL; (Figure 1b) mounted on a pole in the yard; sound level of the activated audible siren was measured as 100 dBS PL at a distance of 100 m. Secondly, for the duration of the experiment superficial lawn maintenance procedures of the type typically encountered in residential settings were eliminated for the yard, including all mowing, cutting, picking, weeding, etc. Thirdly, in an effort to minimize the probability of plant perturbation, all “weed killer” and similarly marketed chemical products and tools were purchased by the principal investigator from local retail vendors, immediately upon shelf appearance. This required repeated, daily visits to said vendors, considerable and unbudgeted out-of-pocket expenditures, and the rental of multiple storage sheds and silos within which to store the several tons of purchased items (Figure 1c)

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A: The garden hose used for initial applications of water to the yard and roadway.
B: The Thunderbolt model 1003 audible siren system. Note, the siren was active during image capture.
C: The silos used to store purchased “lawn care” materials.
D: Example of male technician failing to perform the duties for which he was being compensated.
E: Example of female technician engaged in T. officinale seed dispersal.

Figure 1: Experimental materials and procedures.

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see Appendix for unexpected but notable details of chemical storage conflagration). Fourthly, the services of neighbourhood personnel were purchased to assist in the aerial dispersal of T. officinale seeds. Specifically, a group of technicians (neighbourhood children ages 4-10; n = 11) were initially paid 1 (one) US dollar per hour to daily blow on T. officinale seed heads, including (as a negative control) flower heads not yet gone to seed. The technicians were carefully instructed, with demonstration by the author, to directly repose upon the ground when blowing onto the plants (Figure 1d and 1e) the effectiveness of these repeated instructions was variable (see Results). As an additional control, some technicians were assigned to repose upon the adjoining roadway. To minimize risk of injury the audible siren system was activated once prior to each seed blowing session. Upon unexpected intervention of law enforcement agencies during the experimental period (see Ontario County Criminal Court Records #2014-A-67, -68, and -69) seed blowing tasks subsequent to experiment day 14 were performed by the author immediately following the daily watering procedure. Spatiotemporal data of T. Officinale growth and distribution were collected with optical imagery (Nikon CoolPix S6200).

**Results**

Liberal watering of the yard, in the total absence of mowing, cutting, or any other plant perturbation, was readily achieved. No reports of human or fauna injuries were received, supporting the hypothesis that the inclusion of multiple audible alarm signals prior to each watering event had the desired effect. Watering of the adjacent roadway produced only a modest degree of T. officinale growth (data not shown). Procedural difficulties were encountered early in the experimental period with respect to the services of the technicians. Firstly, the technicians routinely approached their duties in a non-professional manner that negatively impacted the methodological procedures. They would frequently be distracted (e.g., by passing clouds, other technician’s juvenile antics), engage in extracurricular activities (e.g., “playing,” singing “songs”), would make endless demands of the author (e.g., for glasses of lemonade, ice cream cones, and “stories”), would simply sit and perform no work (Figure 1d), and on occasion fall asleep in the yard. Vigorous attention on the part of the author toward these activities was required for adequate experimental progress to be maintained. Secondly, the technicians were confused, and seemingly profoundly unconcerned, about differential identification of T. officinale (the target species) and T. erythrospermum. On dozens of occasions technicians were observed blowing not only upon the seed heads of T. erythrospermum, but also non Taraxacum species. This behavior, which the author attempted but failed to rectify dozens, perhaps hundreds, of times, also impeded experimental progress. Thirdly, after only two days of work the technician’s representatives (i.e., parents) began citing procedurally questionable and unscientifically emotional concerns about the control experiment (i.e., placing technicians “in the middle of traffic”) and initiated daily demands for elevated monetary compensation despite presentation by the author of the technicians’ inferior efforts. These demands were accompanied by baseless criticisms of the audible siren system. Two weeks after experiment onset one of the more loud complaints directed at the author and centered upon dubious claims of “property values” and “noise pollution” (the latter apparently related growth profile exhibited in the yard during this time has been described independently by others as “beyond all bounds” [4,5]. Approximately 21 days following experimental initiation impacts of the horticultural environment upon sociological dynamics within the immediate neighbourhood became particularly acute. Briefly, after many days of complaints directed at the author and centered upon dubious claims of “property values” and “noise pollution” (the latter apparently related

**Figure 2:** Temporal profile of technician compensation. As presented in the Results, the representatives of the technicians (Figure 1d and 1e) made increasing demands upon the author for per hour monetary compensation, initially set at $1 US hr⁻¹, and ultimately terminating at $50 hr⁻¹. On experimental day 15 the technicians were prevented by their representatives from engaging in further work on the project, a seeming violation of the scientific method. The arrowed region indicates the period during which all procedures were performed exclusively by the author.

![Figure 3: Temporal dynamics of T. officinale yard occupation.](image)

A: On experimental day 0, no discernible exemplars of T. officinale were evident. B: Upon termination of the experimental period (experimental day 28) several T. officinale exemplars were evident.
to the audible siren system) several adjoining land owners violated the sanctity of the scientific method by attempting a clandestine mowing of the yard. This event was barely thwarted by the author with activation of the Thunderbolt model 1003 and direct application of the hydrant-supplied water stream (Figure 4). Involvement of local law enforcement activities into the experimental procedure was again unexpected [6] Pending the specific outcome of the related civil and criminal court cases (see Methods), this unanticipated, and heretofore unpublished, attribute of T. officinale cultivation mechanisms will be pursued in future work. Figure 3b illustrates the extent of T. officinale niche occupation immediately upon termination of the experiment. A statistically significant (p < 0.05; Student’s t-test) increase in the niche occupation immediately upon termination of the experiment. Figure 3b illustrates the extent of T. officinale

Discussion

Significant and unexpected experimental criticism was encountered during this test of T. officinale cultivation. This criticism featured discernible isoforms. Several nearby land owners, technician representatives, and even passersby verbally expressed to the author their dissatisfaction with the empirical methodologies, particularly use of the Thunderbolt model 1003 during the early morning hours (inaccurately referred to in the court records as “the middle of the night”). Despite this apparent interest in the scientific method, and repeated demonstrations of the audible alarm efficacy at mitigating injuries associated with the experimental procedures (i.e., yard watering; blowing upon seed heads), these criticisms typically morphed into interference and ultimately legal proceedings. An improved understanding of the role for legitimate scientific experimentation upon jurisprudence seems required for further investigations of T. officinale cultivation. Although such unexpected difficulties threatened the integrity of the cultivation area – the local police and FBI agents expressed a bewildering tendency to stomp carelessly all over the yard – post hoc analysis of the available data demonstrated a significant ability of T. officinale to occupy and dominate a “uniquely urban” environment. Even the arguably negligent efforts of the technicians were unable to retard this behavior, consistent with T. officinale possessing intrinsic capabilities of self-dispersal and growth that were enhanced by the author’s well-designed and novel methodologies. The results thus provide important new insights, will inform municipal efforts to cultivate Taraxacum sp. in urban habitats, and position T. officinale as a valuable horticultural mechanism for urban beautification efforts [7].

Appendix

As presented in the Methods, during the experimental period the author purchased all available “weed killer” chemicals and similarly-marketed products and tools from local retail vendors. This material, which amounted to a weight of several tons, was secured in storage silos (Figure 1c). Unexpectedly it was later discovered that many of the stored chemicals were unstable, heat-sensitive, volatile, reactive with other stored chemicals, or all the above. On experimental day 10 these physical attributes apparently resulted in a surprising and unpredictable series of extreme, rapid, exothermic releases of energy within the silos – termed somewhat colorfully and emotionally by local law enforcement as “explosions” – with the resulting conflagration requiring several
days of attention by local fire fighting forces (Figure 6). Cultivars of *Taraxacum* sp. might consider accounting for the probability of such an event occurring when repeating the methodologies presented here.

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**References**