Biology Paper, CSE Style (Johnson/Arnold)

Distribution Pattern of Dandelion

(*Taraxacum officinale*)

on an Abandoned Golf Course

Title page consists of a descriptive title and the writers' names in the center of the page and the course, instructor, and date centered at the bottom of the page.

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Botany 100A

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Marginal annotations indicate CSE-style formatting and effective writing.

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This paper follows the style guidelines in *Scientific Style and Format: The CSE Manual for Authors, Editors, and Publishers,* 7th ed. (2006).

An abstract summarizes the report in about 100–125 words. You may or may not be required to include an abstract with a brief lab report.

ABSTRACT

This paper reports our study of the distribution pattern of the common dandelion (*Taraxacum officinale*) at an abandoned golf course in Hilton, NY, on 10 July 2005. An area of 6 ha was sampled with 111 randomly placed 1 x 1 m^2 quadrats. The dandelion count from each quadrat was used to test observed frequencies against expected frequencies based on a hypothesized random distribution. We concluded that the distribution of dandelions was not random. We next calculated the coefficient of dispersion to test whether the distribution was aggregated (clumped) or uniform. The calculated value of this coefficient was greater than 1.0, suggesting that the distribution was aggregated. Such aggregated distributions are the most commonly observed types in natural populations.

Introduction states the purpose of the experiment.

INTRODUCTION

Theoretically, plants of a particular species may be aggregated (clumped), random, or uniformly distributed in space [1]. The distribution type may be determined by many factors, such as availability of nutrients, competition, distance of seed dispersal, and mode of reproduction [2].

Citations are numbered in the order in which they appear in the text (citation-sequence system).

The purpose of this study was to determine if the distribution pattern of the common dandelion (*Taraxacum officinale*) on an abandoned golf course was aggregated, random, or uniform.

METHODS

The study site was an abandoned golf course in Hilton, NY. The vegetation was predominantly grasses, along with dandelions, broad-leaf plantain (*Plantago major*), and bird's-eye speedwell

The writers use scientific names for plant species.

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Page header contains an abbreviated title and the page number.

(*Veronica chamaedrys*). We sampled an area of approximately 6 ha on 10 July 2005, approximately two weeks after the golf course had been mowed.

To ensure random sampling, we threw a tennis ball high in the air over the study area. At the spot where the tennis ball came to rest, we placed one corner of a 1 x 1 m^2 metal frame (quadrat). We then counted the number of dandelion plants within this quadrat. We repeated this procedure for a total of 111 randomly placed quadrats.

Detailed description of researchers' methods.

We used a two-step procedure [2]. We first tested whether the distribution of dandelion was random or nonrandom. From the counts of the number of dandelions in our 111 quadrats, we used a log-likelihood ratio (G) test to examine the goodness of fit between our observed frequencies and those expected based on the Poisson series $e^{-\mu}$, $\mu e^{-\mu}$, $\mu^2/2!e^{-\mu}$, $\mu^3/3!e^{-\mu}$, . . . , where μ is the mean density of plants per quadrat. In carrying out this test, we grouped observed and expected frequencies so that no group had an expected frequency less than 1.0 [3]. We then determined whether the distribution was aggregated or uniform by calculating the coefficient of dispersion (ratio of the variance to the mean). A coefficient > 1 indicates an aggregated distribution whereas a coefficient < 1 indicates a more uniform distribution. Finally, we tested the significance of any departure of the ratio from a value of 1 by means of a t-test.

Specialized language of the field.

RESULTS

Headings organize the report into major sections.

Table 1 shows the number of quadrats containing 0, 1, 2, . . . , 17 dandelion plants. More than two-thirds (67.6%) of the

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Table presents the data collected by the researchers in an accessible format.

Table 1 Frequency distribution of dandelion (*Taraxacum officinale*) plants in 1 x 1 m^2 quadrats positioned randomly over 6 ha on an abandoned golf course

Nr per quadrat	Observed frequency (f_i)	Expected frequency (f_i)[a]
0	75	38.68594
1	12	40.77707
2	12	21.49062
3	2	7.550757
4	3	1.989727
5	2	0.419456
6	0	0.073688
7	2	0.011096
8	0	0.001462
9	1	0.000171
10	0	1.8×10^{-5}
11	0	1.73×10^{-6}
12	0	1.52×10^{-7}
13	1	1.23×10^{-8}
14	0	9.27×10^{-10}
15	0	6.52×10^{-11}
16	0	4.29×10^{-12}
17	1	2.66×10^{-13}
	Total 111	

[a] Expected frequencies were calculated from the successive terms of the Poisson distribution (see Methods).

111 quadrats contained no dandelion plants; almost 90% (89.2%) of the quadrats contained fewer than 3 dandelion plants. We observed a highly significant lack of fit between our observed frequencies and expected frequencies based on the Poisson distribution ($G = 78.4$, df = 3, $P < 0.001$). Thus, our data indicated that the distribution pattern of dandelion plants on the abandoned

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golf course was not random. The mean number of dandelion plants per quadrat was 1.05 (SD = 2.50), and the coefficient of dispersion was 5.95. A *t*-test showed that this value is significantly greater than 1.0 ($t = 36.7$, df = 110, $P < 0.001$), which strongly supports an aggregated distribution of the dandelion plants.

DISCUSSION

An aggregated (clumped) distribution is the most commonly observed distribution type in natural populations [4]. Among plants, aggregated distributions often arise in species that have poorly dispersed seeds or vegetative reproduction [2]. In the dandelion, the seeds are contained in light, parachute-bearing fruits that are widely dispersed by the wind. This method of seed dispersal would tend to produce a random distribution. However, dandelion plants also reproduce vegetatively by producing new shoots from existing taproots, and what we considered as groups of closely spaced separate individuals probably represented shoots originating from the same plant. Thus, vegetative reproduction probably accounted for the observed aggregated distribution in this species.

Writers interpret their results and compare them with results of other researchers.

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