

***Polygala smallii* Life History Data Analysis
May 1992 - November 1994**

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I. Methodology of Data Collection

From May 1992 to the fall of 1994 life history data was collected on *Polygala smallii* at two stations, Pine Shore Park and Ludlam Pineland. Each of these stations contain population sizes of over 50 plants. The sites are separated by a distance of about 5 miles. The entire population of *P. smallii* at Ludlam Pineland was monitored. Because the population at Pine Shore Park is large (sometimes over 200 plants) only a subset of the population was chosen for monitoring in a 10 x 10 m plot in the center of the park. Data was collected on a monthly basis at each site. Each plant in the study was numbered with a small aluminum tag placed in the ground next to the plant. The following data was collected on each plant:

1. Diameter (east to west and north to south)
2. Height
3. Number of leaves
4. Number of leaves with herbivore damage
5. Number of immature inflorescences
6. Number of inflorescences with flowers at anthesis
7. Number of senescent inflorescences

II Summary of Data

Data was collected at Pine Shore Park from May 15, 1992 to Nov. 22, 1994. Data was collected at Ludlam Pineland from May 1, 1992 to August 15, 1994. Plants at Pine Shore Park across the study period represent 5 cohorts. When data collection began two cohorts were present on the site but it was impossible to distinguish the two. This group of 37 plants is referred to as cohort A. Cohort B is represented by 51 plants. Cohort C is represented by 29 plants. Cohort D is represented by 41 plants. At Ludlam Pineland data was collected on only 4 cohorts since data from later in 1994 is not available. Cohort A like cohort A at Pine Shore Park, actually includes two inseparable cohorts. It contains 33 plants. Cohort B is represented by 35 plants. Cohort C is represented by 94 plants.

III Analysis

Data was organized using Microsoft Excel Version 7 and Borland Paradox Version 5. Statistical analyses were performed using Statistica Version 4.5. Statistical analyses were confined to Cohort B, the only cohort for which the full life span was observed.

IV Description of Life History

Polygala smallii seedlings were recorded from October to March. Seedling mortality is high at both sites. Estimates produced using Kaplan-Meier Product Limit survival analysis shows that only 50% of the plants are expected to survive more than 108 days at Pine Shore Park and 102 Days at Ludlam Pineland (Kaplan-Meier Product Limit Analysis). After germination, plant size increases until flowering begins at least 3 months following germination. Flowering may be delayed for up to 391 days following germination. After initial flowering, plants flower throughout the year, with no definitely observable peaks in flowering activity. Plants live an average of 6 months. Maximum longevity observed was 18.5 months (560 days).

IV Results

Survivorship

Survivorship in Cohort B is not significantly different between the two sites (Cox's F test, $p = .243$). The mean life length for Cohort B at Pine Shore Park was 211 days and at Ludlam Pineland 172 days. The maximum life length at Pine Shore Park was 560 days (18.5 months), and at Ludlam Pineland 542 days (18 months).

Flowering

Time to initiation of flowering is significantly shorter at Ludlam Pineland (Cox's F-test, $F = -1.58$, $p = .05$). It took an average of 49 days for flowering to be initiated at Ludlam Pineland and an average of 200 days at Pine Shore Park (plants at Ludlam Pineland were more difficult to observe immediately after germinating because of the greater area to survey at this site so the true average is probably somewhat higher). Maximum number of inflorescences produced per plant was significantly higher at Ludlam Pineland (mean = 2.8; SE = 3.6) than at Pine Shore Park (mean = 1.2, SE = 3.4) (Mann-Whitney U test, $z = -1.95$, $p = .05$).

Plant Growth

Maximum plant diameter was significantly higher at Ludlam Pineland (mean = 28.3, SE = 25.4) for Cohort B than at Pine Shore (mean = 15.3, SE = 20.1) (Mann-Whitney U test, $z = -3.08$, $p = .002$). Maximum height was also significantly higher at Ludlam Pineland for cohort B (Mann-Whitney U test, $z = -3.07$, $p = .002$).

Herbivory

Mean herbivory was higher at Ludlam Pineland (3.44) than at Pine Shore (2.01). These differences in herbivory were not statistically significant (Mann-Whitney U test, $z = -1.813$, $p = .07$).

V. DISCUSSION

Polygala smallii is a biennial herb which flowers year-round. Plants germinate from late fall to early spring and may live for as long as 18 months, until the 2nd summer following germination. Analysis of *Polygala smallii* life history data from Pine Shore Park and Ludlam Pineland shows that survivorship rates are similar at the two sites. Seedling mortality is high at both sites, with ca. 50% of plants not surviving past the first 2 to 3 months. While survivorship data is similar, flower activity differs between the two sites. Initial flowering times are much shorter at Ludlam Pineland. Plant size was significantly higher at Ludlam Pineland than at Pine Shore Park. While herbivory rates were higher at Ludlam Pineland, the difference was not statistically significant.

Population sizes at Pine Shore Park were similar across the three cohorts studied (range: 29-41). At Ludlam Pineland the third cohort was much larger than the previous two, showing an almost three-fold increase in population size (range: 33-94). The causes of this increase could not be inferred from available data.