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Pollination biology of *Eriocaulon parkeri* in Connecticut

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Abstract

Eriocaulon parkeri B. L. Robinson is a monoecious, pioneer species of tidal mudflats that displays characteristics that suggest outcrossing as a preferred breeding system. Analyses of breeding system dynamics, fruit set, and pollen and seed viabilities were undertaken in Connecticut and Wisconsin to test the hypothesis of entomophyly and outcrossing as a preferred breeding strategy. Potential pollinators included syrphid and long-legged flies. Seed viability was estimated at $94 \pm 16\%$ ($n = 133$); pollen viability at $88 \pm 13\%$. Pollen production averaged ~500 grains per flower. Pollen–ovule ratios within inflorescences averaged 196:1, suggesting facultative autogamy. Seed set in natural populations averaged 74%, not significantly different between early and late season plants or between greenhouse controls and hand pollinations. Emasculated plants produced small amounts of seed under controlled greenhouse conditions. Pollen tube growth through the styles of *E. aquaticum*, a related species, was much more prevalent than that of *E. parkeri*. Results suggest that *E. parkeri* relies heavily on geitonogamy for seed production. Some seed may be produced by agamospermy.

Keywords: Reproduction; Breeding system; Agamospermy; Eriocaulaceae; Greenhouse studies

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1. Introduction

Eriocaulon parkeri B. L. Robinson, Parker's or estuary pipewort, is distributed along the eastern coast of North America from North Carolina to Maine and the St. Lawrence Seaway (Fernald, 1950; Kral, 1966; Gleason and Cronquist, 1991). The Connecticut Department of Environmental Protection (2000) has listed Parker's pipewort as threatened in the state of Connecticut. Although historically occurring in all coastal Connecticut counties bearing estuaries (Fassett, 1928), its distribution currently is limited to brackish and freshwater, tidal mudflats associated with the lower Connecticut River drainage. The primary reason for its decline in Connecticut and throughout its range is the loss of habitat due to human disturbance. In its mudflat habitat it is associated with several other state listed species including *Bidens eatonii* Fern., *Crassula aquatica* (L.) Schönl., *Limosella subulata* Ives, *Orontium aquaticum* L., and *Sagittaria subulata* (L.) Buchenau. All these species occur where daily tidal fluctuations result in submersion of flowering structures. It may prove important for the preservation of *E. parkeri* to understand its breeding system and the limitations placed on this system by its tidally influenced estuarine habitat.

Eriocaulon parkeri is a small annual monocot, producing one or two flowering stalks less than 10 cm long from a rosette of short linear leaves. Plants are monoecious, producing small flowers (∼2 mm long) arranged in dense heads less than 5 mm wide. Male flowers typically occur in the center of the head, ringed by bi-ovulate female flowers. Inflorescences show some dichogamy, tending to be protandrous, but significant overlap occurs between stigma receptivity and the release of pollen.

The presence of nectaries and of dorsifixed anthers in *E. parkeri* argues for entomophyly in this species. In this study, we test the hypothesis of entomophyly, and attempt to determine which of three breeding systems (outcrossing, selfing, agamospermy) is operating most frequently in a large Connecticut population. In addition, we evaluate its reproductive strategy in relation to its habitat and its rarity.

2. Materials and methods

To determine breeding system preferences of *Eriocaulon parkeri* in a large Connecticut population, field studies were conducted among wild plants in Hamburg Cove (Lyme, Connecticut) during the spring and summer months of 2000 and 2001.

To obtain a quantitative estimate of pollinator activity on *E. parkeri* inflorescences and thereby an estimate of entomophyly and outcrossing in a wild population, 302 plants from two areas in the cove were observed and assessed, each during 10 min intervals, for the frequency of insect visitation and insect movement patterns. Both insect visitors and pollen from flowers of *E. parkeri* were collected. To distinguish pollinators from non-pollinating visitors (Faegri and Van der Pijl, 1979), insects collected in the field were later surveyed for the presence or absence of pollen grains. Pollen was removed and compared with that collected from *E. parkeri*. Voucher specimens of all insect visitors have been deposited in the University of Connecticut insect collection.

Seed set in the wild population was calculated by counting fruit and seed among randomly sampled early flowering (25 plants before June 15) and late flowering (15 plants