



Taxonomic investigation of *Erigeron lackschewitzii*
by Tulli Ann Kerstetter

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in
Biological Sciences
Montana State University
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Abstract:

This study investigates the taxonomic status of *Erigeron lackschewitzii* Nesom and Weber (Asteraceae), a narrow Montana endemic restricted to windy, exposed ridgelines and calcareous substrates in the Bob Marshall and Scapegoat Wildernesses of northwestern Montana. By means of morphological and molecular techniques, the relationships of *E. lackschewitzii* to four other *Erigeron* (*E. grandiflorus*, *E. simplex*, *E. ochroleucus* var. *scribneri*, *E. radicans*) were investigated in order to ascertain parentage and determine whether populations of this taxon were sufficiently distinct to warrant specific status. A total of 307 individuals comprising the five species were examined. In addition, six other species were included as outgroups in genetic analyses in order to estimate the direction of evolution of genetic markers. Lack of success in obtaining chromosome counts from root tips prompted an analysis of the number of stomates per unit area and estimates of mean stomate sizes of populations of each of the five species. Results suggest that plants belonging to *E. lackschewitzii* are tetraploid. Chloroplast DNA (cpDNA) restriction site analysis with ten restriction endonucleases revealed two mutations unique to *E. lackschewitzii* and further supported a relationship of *E. lackschewitzii* to *E. ochroleucus* var. *scribneri*. A phenetic analysis of Random Amplified Polymorphic DNA (RAPD) markers likewise revealed that *E. lackschewitzii* is distinct from other *Erigeron* and most closely related to *E. ochroleucus* var. *scribneri*. Individuals from populations of *E. lackschewitzii* were found to be genetically uniform, suggesting recency of origin from a single progenitor individual or population. Results from genetic studies corroborate findings from geographic and population phenetic analyses of morphological data, suggesting that populations of *E. lackschewitzii*, although closely related to *E. ochroleucus* var. *scribneri*, are sufficiently distinct to warrant species status. The persistent lack of pollen in individual *E. lackschewitzii* examined, coupled with the presence of fully formed achenes at a very early state of floret development, suggest some form of apomixis. Populations of *E. lackschewitzii* most likely resulted from selection for traits often found in other polyploid derivatives that colonize areas left barren after glaciation, with maintenance of the adaptive genotype through apomixis.

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This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.

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Signature *Heidi Ann Kerstetter*
Date *November 28, 1994*

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ABSTRACT

This study investigates the taxonomic status of *Erigeron lackschewitzii* Nesom and Weber (Asteraceae), a narrow Montana endemic restricted to windy, exposed ridgelines and calcareous substrates in the Bob Marshall and Scapegoat Wildernesses of northwestern Montana. By means of morphological and molecular techniques, the relationships of *E. lackschewitzii* to four other *Erigeron* (*E. grandiflorus*, *E. simplex*, *E. ochroleucus* var. *scribneri*, *E. radicans*) were investigated in order to ascertain parentage and determine whether populations of this taxon were sufficiently distinct to warrant specific status. A total of 307 individuals comprising the five species were examined. In addition, six other species were included as outgroups in genetic analyses in order to estimate the direction of evolution of genetic markers. Lack of success in obtaining chromosome counts from root tips prompted an analysis of the number of stomates per unit area and estimates of mean stomate sizes of populations of each of the five species. Results suggest that plants belonging to *E. lackschewitzii* are tetraploid. Chloroplast DNA (cpDNA) restriction site analysis with ten restriction endonucleases revealed two mutations unique to *E. lackschewitzii* and further supported a relationship of *E. lackschewitzii* to *E. ochroleucus* var. *scribneri*. A phenetic analysis of Random Amplified Polymorphic DNA (RAPD) markers likewise revealed that *E. lackschewitzii* is distinct from other *Erigeron* and most closely related to *E. ochroleucus* var. *scribneri*. Individuals from populations of *E. lackschewitzii* were found to be genetically uniform, suggesting recency of origin from a single progenitor individual or population. Results from genetic studies corroborate findings from geographic and population phenetic analyses of morphological data, suggesting that populations of *E. lackschewitzii*, although closely related to *E. ochroleucus* var. *scribneri*, are sufficiently distinct to warrant species status. The persistent lack of pollen in individual *E. lackschewitzii* examined, coupled with the presence of fully formed achenes at a very early state of floret development, suggest some form of apomixis. Populations of *E. lackschewitzii* most likely resulted from selection for traits often found in other polyploid derivatives that colonize areas left barren after glaciation, with maintenance of the adaptive genotype through apomixis.

CHAPTER 1

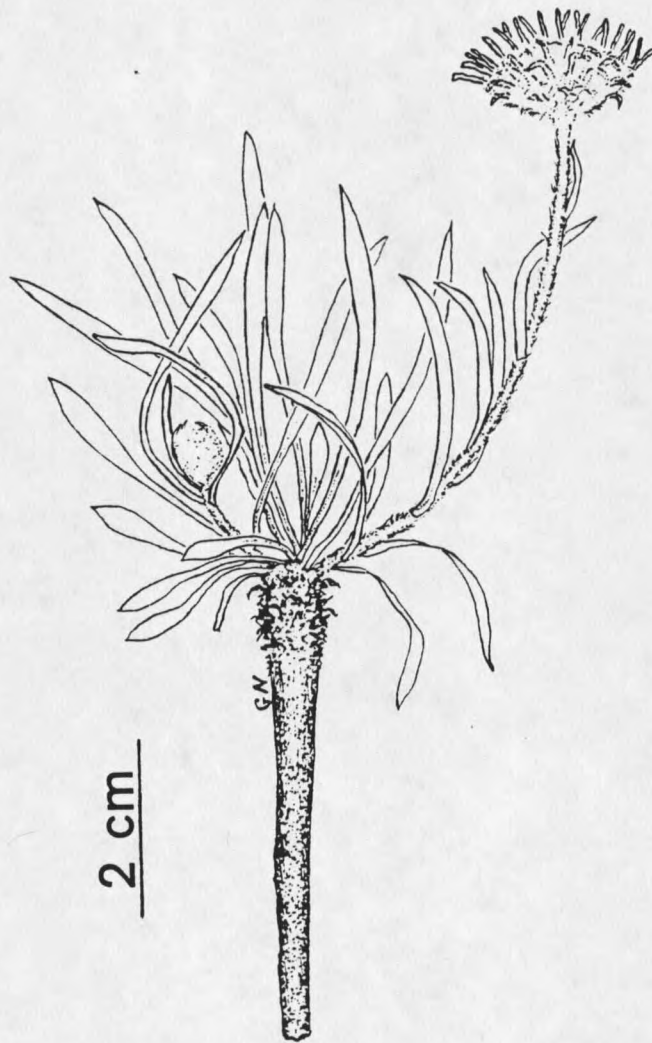
INTRODUCTION

Erigeron lackschewitzii Nesom and Weber (Figure 1) is described as a narrow endemic from the Bob Marshall and Scapegoat Wildernesses of northwestern Montana (Nesom and Weber, 1983). The species description is based on 18 individual plants in two collections from the Flathead Range and named for its collector, Klaus Lackschewitz, of Missoula. Judging from the very few and highly abortive pollen grains produced by plants of this taxon, the species is believed by its authors to be apomictic and probably polyploid.

Erigeron lackschewitzii is currently included in Category 2 of the U.S. Fish and Wildlife Service Notice of Review under consideration for federal listing as a threatened or endangered plant species and has been tracked by the Lewis and Clark National Forest as a species of concern (Heidel, 1993). It is currently ranked as "threatened throughout its range, but having taxonomic questions associated with it." The Montana Natural Heritage Program lists *E. lackschewitzii* as "imperiled" at both the global and state level, and the taxon was previously listed as "rare in Montana" by the Montana Rare Plant Project, according to Heidel.

Erigeron lackschewitzii is one of the few endemics in Montana (Heidel, 1993). It is found in exposed alpine settings on limestone substrates of the Madison group and Devonian formations containing dolomite. The species is known from 12 sites in four

Fig. 1. *Erigeron lackschewitzii* Nesom and Weber. From Nesom and Weber, 1983.



counties (Teton, Flathead, Pondera, Lewis and Clark) within a north-south 45-mile perimeter along the Front Range. *Erigeron lackschewitzii* grows in association with intermittent mats of *Dryas octopetala* as well as *Arctostaphylos uva-ursi*, with *Carex rupestris* as the dominant sedge between mats, according to Heidel. The mats of *Dryas*

octopetala occupy exposed, snow-free sites on calcareous parent material where the soil is thin, rocky and unstable, acting as stable microsites in which other species of plants are able to exist (Bamberg, 1964).

The species is most frequently found on exposed alpine slopes with a southwest aspect, with smaller alpine and subalpine populations facing northwest (Heidel, 1993). Elevation ranges from 1951m to 2500m. *Erigeron lackschewitzii* is not a dominant community type, and populations range from 5 to 500 individuals in about 10 acres for denser populations to a mile for more scattered groups, according to Heidel. The largest populations (over 200 individuals) are found at Headquarters Creek Pass, Sock Lake, Crown Mountain, and Our Lake (Figure 2).

According to Nesom and Weber (1983), *E. lackschewitzii* is most closely related to *E. simplex* Greene and the southern alpine race of *E. grandiflorus* Hooker sensu Spongberg (1971). This relationship is inferred by the shared occurrence of monocephalous stems with entire leaves, involucre bracts with lanate-villous indumentum, blue-rayed outer florets, and an outer pappus of conspicuous squamellae. Additionally, cross walls of involucre trichomes are often pigmented red-purple, particularly near the base, in all three taxa. *Erigeron lackschewitzii* differs from both *E. simplex* and the southern alpine race of *E. grandiflorus* in the following features, as quoted from Nesom and Weber (1983):

1. Basal leaves linear-oblongate to narrowly oblongate without a well-demarcated blade versus spatulate in *E. simplex* and *E. grandiflorus*.
2. Ray flowers equal 30-68 versus 50-125 in *E. simplex* and 56-123 in *E. grandiflorus*.
3. Stem pubescence woolly-villous with glandularity lacking or not evident versus spreading but not villous or woolly, with erect, stipitate-glandular

