Growth of *Gutierrezia sarothrae* seedlings in the field

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Abstract

Broom snakeweed (*Gutierrezia sarothrae* [Pursh] Britt. and Rusby) has increased in density and distribution on many southwestern ranges. The objective of this study was to determine root and shoot development of snakeweed seedlings as an aid in understanding the establishment of the species. Broom snakeweed seedlings were excavated from the field from March through September at approximately monthly intervals to determine biomass of roots and shoots. Root and shoot biomass growth was comparable from March to July, but shoot growth exceeded that by roots for the rest of the growing season. Root:shoot ratios were below 0.6 for the entire growing season, suggesting that rapid root development is not the primary mechanism for colonizing disturbed areas.

Key Words: broom snakeweed, root:shoot ratios

Broom snakeweed (*Gutierrezia sarothrae* [Pursh] Britt. and Rusby) is a species noted for its wide fluctuations in population numbers (McDaniel 1984, McDaniel et al. 1984, Sosebee, Boyd and Bromley 1979, Jameson 1970). The species appears to be opportunistic and rapidly colonizes disturbed sites. One characteristic that enables broom snakeweed to invade areas rapidly is production of large numbers of seeds, which can remain viable in the soil for considerable periods (McDaniel 1979, Ragsdale 1969). Broom snakeweed populations have increased substantially on southwestern range during the last decade (McDaniel et al. 1984, Ueckert 1979). It is considered an undesirable plant on these rangelands because of competition with desirable forage plants and because of its toxic properties (McDaniel et al. 1982, Ueckert 1979).

Rapid development of shoot and root systems would also be an advantage for rapid establishment. Nadabo et al. (1980) studied volume growth of mature broom snakeweed plants, but pointed out that information on seedling growth is lacking. Consequently, the objective of this study was to determine biomass and extent of shoots and roots of broom snakeweed seedlings under field conditions.

Materials and Methods

This study was conducted on the New Mexico State University College Ranch about 32 km north of Las Cruces, New Mexico. Topography is nearly level with elevations ranging from about 1,200 m to 1,400 m. Rainfall reaches a peak from July through September, when about 53% of the annual total of 220 mm occurs (Paulsen and Ares 1962).

Soils of the study area have been classified as a mixed, Thermic Typic Paleothrid in the Harrisburg series (Bulloch and Neher 1980). Surface texture is sandy loam to a caliche layer at 40 to 70 cm. The area is nearly level.

Vegetation of the study is composed of a dense stand of broom snakeweed, with mesa dropseed (*Sporobolus flexuosus* [Thurb] Rydb.), spike dropseed (*S. contractus* Hitch.), fluffgrass (*Erioneuron pulchellum* [H.B.K.] Takeoka), black grama (*Bouteloua eriopoda* Torr.), and several forb species in the interspaces. Honey mesquite (*Prosopis juliflora* [Swartz] DC. vr. *glandulosa* [Torrey] Cockerell) is scattered throughout the area.

Annual precipitation during the year of the study was 1 cm lower than the long-term average and that from February through September was only 0.4 cm greater than the long-term average.

In mid-February, 40 broom snakeweed seedlings were marked in the field. Six seedlings selected at random were excavated ever 5-6 weeks during the growing season until September. These plants germinated and emerged during the fall. Individual root systems and attached soil were soaked in water until most of the soil was detached from the roots. The remaining soil was gently washed from the roots. Care was taken to include fine roots but some were undoubtedly lost. Length of both roots and tops was measured, and living root and shoot material was oven-dried (75° C) and weighed. Means and standard errors were calculated for root and shoot biomass at each sampling date.

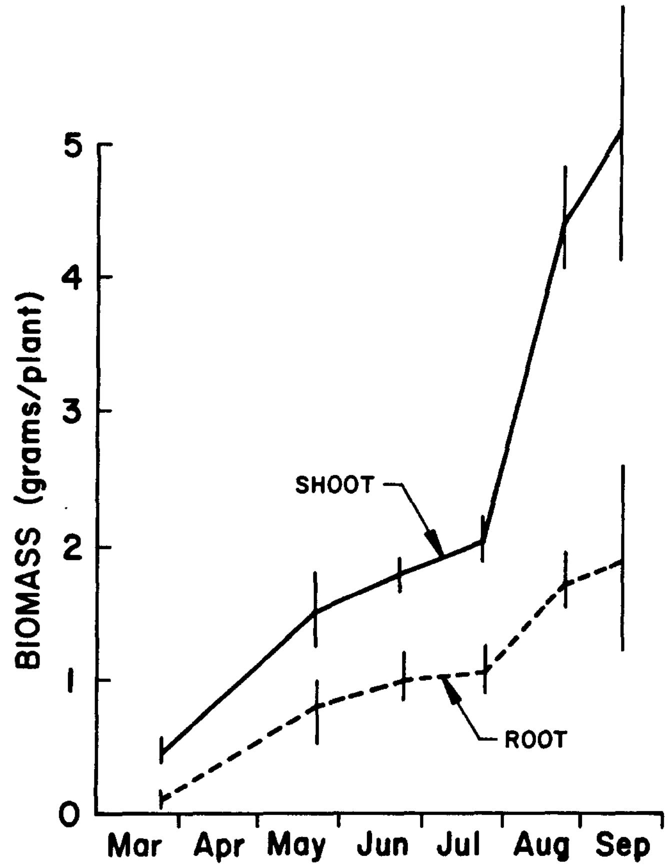

Fig. 1. *Shoot and root biomass of broom snakeweed seedlings during the growing season. Vertical bars indicate standard errors.*

Results

Biomass curves for shoot and roots were roughly parallel from March through July (Fig. 1). However, shoot growth accelerated at a much more rapid rate during August and September than root growth. Root development was apparently adequate to supply the needed water and nutrients for rapid top growth during the latter part of summer.

Root:shoot biomass ratios were nearly constant at about 0.5

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Table 1. Root:shoot biomass ratios of broom snakeweed seedlings during the growing season.

Date	Root:shoot ratio
March 23	0.33
May 21	0.53
June 24	0.56
July 25	0.49
August 26	0.39
September 25	0.36

during the early summer growing period, indicating nearly equal growth (Table 1). However, during August and September when shoot growth accelerated, the ratios decreased to less than 0.4. These changes appear to be consistent with data for other desert species (Chew and Chew 1965, Walters and Freeman 1983). Barbour (1973) reported the root:shoot ratios were less than 1 for many desert species, and often less than 0.5 for mature plants.

Root biomass alone may not be a good indicator of total root development. Depth of rooting and lateral root spread may also be important in the establishment of a root system. Mean root length exceeded mean shoot height by a factor greater than 2 on all dates. Mean rooting depth was 45 cm on 25 August when mean shoot height was only 21 cm. These rates of root spread appear to be well within ranges reported for other desert species (Barbour 1973).

It appears that ability of broom snakeweed to colonize a site rests more with its reproductive potential and possible early establishment, rather than accelerated early root growth. Seedling growth rates appear comparable to those for other desert species. However, additional study is warranted to see if similar results are obtained in other areas and years.

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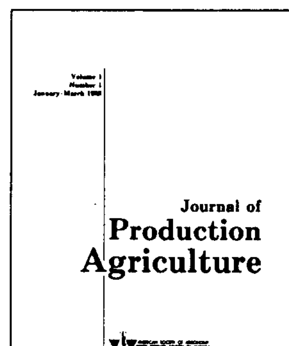

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