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Mesquite (*Prosopis glandulosa*) germination and survival in black-grama (*Bouteloua eriopoda*) grassland: relations between microsite and heteromyid rodent (*Dipodomys* spp.) impact

B.D. Duval[a,*], E. Jackson[b,c], W.G. Whitford[a,b]

[a]*Department of Fishery and Wildlife Sciences, New Mexico State University, Las Cruces, New Mexico, 88001, USA*

[b]*USDA-ARS Jornada Experimental Range, New Mexico State University, Las Cruces, New Mexico, 88001, USA*

[c]*Titan Corporation, Elmendorf Air Force Base, Anchorage, Alaska, USA*

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Abstract

We conducted experiments to examine microsite and rodent influence on mesquite (*Prosopis glandulosa*) germination and survival in Chihuahuan Desert black-grama (*Bouteloua eriopoda*) grassland. Simulated caches with mesquite seeds were placed in undisturbed grassland, burned grassland patches with reduced grass cover, and on the periphery of kangaroo rat mounds. Rodent access to cached seeds was controlled by covering half of the caches with mesh domes. Kangaroo rats destroyed dung pats containing scarified mesquite seeds and excavated all seeds in simulated caches during a year in which no grasses or forbs set seed. Germination was the highest in unburned grassland, but over-winter survival was only observed across experiments in burned grassland microsites. A large proportion of seed caches were excavated (1.1–5.5% of the rodent-excluded caches and between 15.6% and 21.1% of the control caches). There were seasonal differences in numbers of emergent seedlings, with a peak in September 2002 following late summer rains. There were no significant differences in numbers of germinants in burned and unburned grassland microsites, but significantly fewer mesquite seeds germinated on banner-tail kangaroo rat mounds. Caches excavated by rodents yielded 46.6% of

*Corresponding author. Tel.: +1 505 646 8032; fax: +1 505 646 5889.
E-mail address: bduval@nmsu.edu (B.D. Duval).

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germinants. This study suggests that scarification of mesquite seeds is not necessary for germination and heteromyid rodents may be responsible for increased mesquite density in grasslands with some mature mesquite plants. The data also suggest that competition between mesquite seedlings and grasses in black-grama grassland is weak because of the physical characteristics of this system.

Keywords: Banner-tail kangaroo rats; Black-grama grassland; *Bouteloua eriopoda*; Fire; Germination; Heteromyid rodents; Mesquite; *Prosopis glandulosa*

1. Introduction

The once expansive arid grasslands of North America's Chihuahuan Desert have largely been converted to shrub savannas, honey mesquite (*Prosopis glandulosa*) coppice dunes, and creosotebush (*Larrea tridentata*) shrublands during the past 150 years (Buffington and Herbel, 1965; Grover and Musick, 1990; Archer, 1989). Mesquite is thought to have spread from drainages and riparian zones into upland desert grasslands (Johnston, 1963; Archer et al., 1988).

Van Auken and Bush (1987, 1988, 1989, 1990) reported that mesquite is a poor competitor with grasses, including buffalo grass (*Buchloe dactyloides*), little bluestem (*Schizachyrium scoparium*) and side oats grama (*Bouteloua curtipendula*). However, these grass species are minor components of Chihuahuan desert grassland communities (Dick-Peddie, 1993). Historically, black-grama (*Bouteloua eriopoda*) is the dominant grass species in much of the upland Chihuahuan desert grassland of southern New Mexico, southeastern Arizona, northeastern Mexico and west Texas. There is generally less perennial grass cover in black-grama systems than in the south Texas grasslands studied by Van Auken and Bush, and that difference may affect the competitive interactions between mesquite and grasses in Chihuahuan Desert grasslands.

Large mesquite shrubs in former black-grama grasslands are frequently associated with burrow mounds of banner-tail kangaroo rats (*Dipodomys spectabilis*). Anecdotal evidence from ranchers suggests that mesquite on or around mounds had been "planted" by kangaroo rats. Banner-tail kangaroo rat mound soils are characterized by higher infiltration rates, greater concentrations of nitrogen, higher nitrogen mineralization rates, accelerated microbial activity and greater plant biomass than surrounding soils (Moorhead et al., 1988; Mun and Whitford, 1990; Ayarbe and Kieft, 2000). These characteristics of banner-tail kangaroo rat mound soils may enhance germination and growth of mesquite seeds cached near or on the margins of the mounds.

The dispersal of mesquite from ephemeral stream and ephemeral lake margins has been attributed to the consumption of mesquite fruit pods and seeds by livestock. When domestic animals consume mesquite seeds, they pass through the animal's digestive tract, a process that enhances the germinability of mesquite, and the seeds are then often deposited in areas distant from the parent plants (Brown and Archer, 1989; Kramp et al., 1998).