

NOTES

ECTOPARASITES ON THE GIANT KANGAROO RAT, CARRIZO PLAIN NATIONAL MONUMENT, SAN LUIS OBISPO COUNTY, CALIFORNIA

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Abstract.—The Giant Kangaroo Rat (*Dipodomys ingens*) is a keystone species endemic to the San Joaquin Valley of California and adjacent valleys, and is listed by both California and the federal government as Endangered. Little is known regarding the occurrence of ectoparasites on Giant Kangaroo Rats. Previous work resulted in the identification of two flea species (*Hoplopsyllus anomalus* and *Meringis californicus*) and ticks (*Ixodes* sp.) on Giant Kangaroo Rats on the Carrizo Plain in San Luis Obispo County, California (Tabor et al. 1993). One additional flea species, *Echidnophaga gallinacea*, was identified on Giant Kangaroo Rats during trapping efforts within the same geographical location.

Key Words.—California; *Dipodomys ingens*; endangered species; fleas; kangaroo rat; parasites

The Giant Kangaroo Rat (*Dipodomys ingens*) is a keystone species endemic to the San Joaquin Valley of California and adjacent valleys (Goldingay et al. 1997; Schiffman 1997), and is listed by both California and the federal government as Endangered (U.S. Fish and Wildlife Service 1998). The primary causes of endangerment are loss of habitat due to land conversion (urban development and agriculture) and fragmentation by the development of highway and water delivery infrastructures (U.S. Fish and Wildlife Service 1998). Little is known regarding the occurrence of ectoparasites on the Giant Kangaroo Rat. Previous work resulted in the identification of two flea species (*Hoplopsyllus anomalus* and *Meringis californicus*) and ticks (*Ixodes* spp.) on Giant Kangaroo Rats on the Carrizo Plain, San Luis Obispo County, California (Williams and Kilburn 1991; Williams 1992; Tabor et al. 1993). Here we identify one additional flea species occurring on the Giant Kangaroo Rat not previously reported.

From 27–28 October 2011, we established one trapping grid on a private inholding within the Carrizo Plain National Monument (T11N, R26W, Sec 1; elevation 670 m). We used Sherman live traps (7.5 × 9.5 × 30.5 cm; H.B. Sherman Traps, Tallahassee, Florida) in a 10 × 10 grid with 10-m centers (100 total traps). We baited traps with white proso millet and placed an unbleached paper towel inside. We set traps shortly before sunset and closed them 3–4 h later. All captured rodents were identified to species and we recorded mass, hind foot length, sex, general health, age, and reproductive condition. To permanently mark animals, we injected a passive integrated transponder (PIT) tag under the dorsal surface between the shoulder blades. We collected fleas from Giant

Kangaroo Rats and placed them in a glass vial (6 × 60 mm) filled with 70% isopropyl alcohol. Following data and flea collection, we released captured rodents at the trap site. We identified fleas to species using field keys (Hubbard 1947; Holland 1949; Campos 1971; Lewis et al. 1988), mounted fleas on glass slides, and deposited them at the Denver Museum of Nature & Science (DMNS; 2001 Colorado Boulevard, Denver, Colorado 80205).

We captured 16 Giant Kangaroo Rats (three males; 13 females) and collected six fleas that we identified to three species, one of which has not been previously reported as occurring on Giant Kangaroo Rats: *Echidnophaga gallinacea*. *Meringis californicus* ($n = 1$; DMNS accession number ZE.45276; Fig. 1) are commonly associated with *Dipodomys* species (Ewing and Fox 1943) and *Echidnophaga gallinacea* ($n = 2$; accession numbers ZE.45280 and ZE.45281; Fig. 2) are typically found on domestic poultry and rodents (Koehler et al. 2009). *Hoplopsyllus anomalus* ($n = 3$; accession numbers ZE.45277, ZE.44278, and ZE.45279; Fig. 3) are commonly associated with sciurids, but on the Carrizo Plain, Giant Kangaroo Rats have largely filled the sciurid niche (Tabor et al. 1993).

Tabor et al. (1993) collected 283 fleas from 67 Giant Kangaroo Rats, with an average of 4.34 fleas per kangaroo rat. Of these 283 fleas, all were *Hoplopsyllus anomalus* (92 males, 189 females, one unknown) except for one male *Meringis californicus*. All fleas collected in our study were female. Tabor et al. (1993) also had a female-biased sampling, with two females collected for every male. Females are larger than males and are typically able to survive longer than males (Krasnov 2008).

Fleas and other parasites can potentially adversely affect their host species (Clark et al. 2006). However, from examining the Giant Kangaroo Rats with fleas during our study, we did not observe unhealthy or weakened kangaroo rats due to infestations. Fleas rarely numbered more than two or three on any individual, with many kangaroo rats not harboring fleas. Precinct excavation work occurring on a nearby study site did not show any noticeable infestations of the burrow systems (Howard Clark, unpubl. data). Low numbers of fleas may be a function of the time of the year fleas were collected. For example, *E. gallinacea* were primarily collected during the spring in one study (Metzger 2000) where soil moisture is relatively higher than in the fall when our study occurred. Both *E. gallinacea* and *H. anomalus* are commonly associated with California ground squirrels (*Otospermophilus beecheyi*) and although no ground squirrels were within the immediate vicinity of our study grids, the species occurs regionally and may facilitate parasite exchange.

Occasionally, when a burrow or den system of a mammal becomes infested, the host will abandon the burrow or den (Kilgore 1969). Abandonment of precincts by Giant Kangaroo Rats due to parasite infestations has not been documented and it appears that flea loads on Giant Kangaroo Rats is low to moderate at most. Our finding of multiple species of fleas on Giant Kangaroo Rats at one locality show that parasitic biodiversity can be high and further research is needed to determine how Giant Kangaroo Rats manage flea loads and what effects fleas have on kangaroo rat populations, if any.

Acknowledgements.—SunPower Corporation, Inc., provided support for this study. We thank Susan I. Hagen for improving the manuscript. We thank Jeff Stephenson, collections manager at the Denver Museum of Nature & Science, for specimen accession. Giant Kangaroo Rats were handled and processed under the authority of U.S. Fish and Wildlife Service permit TE-797267-16, a Memorandum of Understanding by and between H.T. Harvey & Associates and the California Department of Fish and Wildlife (CDFW), and a CDFW-issued scientific collecting permit (SCP 003366). Darren P. Newman assisted with trapping.

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Figure 1. Female *Meringis californicus* collected from a Giant Kangaroo Rat (*Dipodomys ingens*) on the Carrizo Plain National Monument, San Luis Obispo County, California. (Photographed by Helen Pigage).



Figure 2. Female *Echidnophaga gallinacea* collected from a Giant Kangaroo Rat (*Dipodomys ingens*) on the Carrizo Plain National Monument, San Luis Obispo County, California. (Photographed by Helen Pigage).



Figure 3. Female *Hoplopyllus anomalus* collected from a Giant Kangaroo Rat (*Dipodomys ingens*) on the Carrizo Plain National Monument, San Luis Obispo County, California. (Photographed by Helen Pigage).

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HOWARD O. CLARK, JR., is a Certified Wildlife Biologist® with nearly 20 years of professional wildlife and research experience. He earned his Master's degree in Biology from California State University, Fresno in 2001. His work as a researcher focused on the fauna and ecosystems of Northern, Central, and Southern California, and the Mojave Desert provinces and included extensive baseline mammalian inventories, surveys focused on rare animals, habitat assessment, radio telemetry, and long-term ecological studies on several endangered species. He regularly works with the Western Burrowing Owl (*Athene cunicularia*), San Joaquin Kit Fox (*Vulpes macrotis mutica*), Giant Kangaroo Rat (*Dipodomys ingens*), Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*), and the Mohave Ground Squirrel (*Xerospermophilus mohavensis*). He is currently a senior wildlife ecologist with Garcia and Associates, Fresno, California. (Photographed by Graham Biddy).



HELEN K. PIGAGE earned her D.A. from the University of North Dakota in 1979. She taught biology courses (Anatomy and Physiology, Microbiology, Parasitology, and General Biology) for 43 years before retiring in July 2012. Her college teaching experience included work at West Liberty State College (West Virginia), Elmhurst College (Illinois), and the United States Air Force Academy (Colorado Springs, Colorado). She has conducted research on pocket gophers (*Thomomys bottae*), Eastern Woodrats (*Neotoma floridana*), and Mule Deer (*Odocoileus hemionus*). She is currently investigating molecular genetics of Abert's Squirrels (*Sciurus aberti*) with several colleagues. In addition, she is a Research Associate in the Zoology Department of the Denver Museum of Nature & Science working on the Department's flea collection. (Photographed by Rick Clawges).



COLIN A. WILKINSON earned his Bachelor's degree from the University of California, Santa Cruz in 2006. He worked for the California State University, Endangered Species Recovery Program from 2007 to 2010. He has conducted research on Giant Kangaroo Rats (*Dipodomys ingens*), Fresno Kangaroo Rats (*D. nitratoides exilis*), Tipton Kangaroo Rats (*D. n. nitratoides*), Spotted Owls (*Strix occidentalis*), California Tiger Salamanders (*Ambystoma californiense*), California Red-legged Frogs (*Rana draytonii*), and San Joaquin Kit Foxes (*Vulpes macrotis mutica*). He is currently working as a Plant and Wildlife Ecologist for H. T. Harvey & Associates in Fresno, California. (Photographed by Howard Clark).



ROBERT K. BURTON earned his Ph.D. from the University of California, Santa Cruz in 2000. He has worked with a wide variety of species including the Western Snowy Plover (*Charadrius nivosus nivosus*), California Least Tern (*Sternula antillarum browni*), Southern Sea Otter (*Enhydra lutris nereis*), Giant Kangaroo Rat (*Dipodomys ingens*), San Joaquin Kit Fox (*Vulpes macrotis mutica*) as well as riparian restoration in California and Arizona. He is currently an Associate Wildlife Ecologist with H. T. Harvey & Associates, an ecological consulting group in California. (Photographed by Kristy Uschyk).