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Source: The Southwestern Naturalist, 63(1) : 64-67

Published By: Southwestern Association of Naturalists

URL: https://doi.org/10.1894/0038-4909.63.64

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THE SOUTHWESTERN NATURALIST 63(1): 64–67

NINE-BANDED ARMADILLO (*DASYPUS NOVEMCINCTUS*) NEW RECORDS, DISTRIBUTION, AND HABITAT IN SONORA, MEXICO

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ABSTRACT—We obtained 23 new records of nine-banded armadillos (*Dasypus novemcinctus*) in the state of Sonora, Mexico, that extend their known distribution range. Nine-banded armadillos are not well known in Sonora, where their habitat encompasses vegetation types that include tropical thornscrub, a transitional biome between Sonoran desertscrub and tropical deciduous forests, and oak woodland, excluding the Sonoran desertscrub. They occur from 50 to 1,656 m above sea level. Precipitation restricts their distribution to areas with a mean annual precipitation of ≥300 mm; otherwise, they occupy irrigation areas and riparian habitats. It is possible that the range of nine-banded armadillos is expanding in Sonora.

RESUMEN—Obtuvimos 23 registros de armadillo (*Dasypus novemcinctus*) para el estado de Sonora, México, extendiendo su distribución conocida. Los armadillos no son muy conocidos en Sonora, donde su hábitat es de diferentes tipos de vegetación, incluyendo el matorral espinoso tropical, la transición entre el matorral espinoso sonorense y la selva baja caducifolia, y bosques de encino, excluyendo el matorral espinoso sonorense. Ocurren desde los 50 a los 1,656 m sobre el nivel del mar. La precipitación restringe su distribución a áreas con un promedio de precipitación anual de ≥300 mm. De otra manera ocupan áreas de irrigación y hábitats riparios. Es posible que la distribución de los armadillos se esté expandiendo en Sonora.

The nine-banded armadillo (*Dasypus novemcinctus*) is found from northern South America to Mexico and is recently expanding through the southeastern United States (Taulman and Robbins, 1996, 2014). In Mexico, the nine-banded armadillo primarily occurs in the tropical areas (Mendoza-Durán, 2005). Allen (1906) reported two individuals captured near San Miguel on the Río Fuerte just south of the Sonoran border in Sinaloa; this report represented the northwestern-most record in Mexico at that time. Leopold (1959) suggested that armadillos should be present in Sonora. Armstrong and Jones (1971) mentioned the possibility of finding armadillos along the tributaries of the Río Fuerte near Álamos in southern Sonora. They also suggested they might occur in the Rio Yaqui drainage because the vegetation of these two rivers is similar and agricultural developments might facilitate their presence. Hall (1981) suggested their presence at Río Oteros in southwestern Chihuahua, near the Sonora border. Caire (1978) proposed that the limits of their northwestern distribution would be in the Sonoran Desert north of Guaymas, Sonora. Here, we present armadillo observations from Sonora obtained during 23 years of fieldwork studying several other mammals, by conducting biotic inventories, and by detailing the ethnobotany of the Mayo Indians (Yetman and Van Devender, 2002; Fig. 1; Table 1). We include three records reported in Castillo-Gámez et al. (2010). Schwalbe and Lowe (2000) listed armadillos as part of the fauna of the Sierra de Álamos-Río Cuchujaqui Área de Protección de Flora y Fauna.

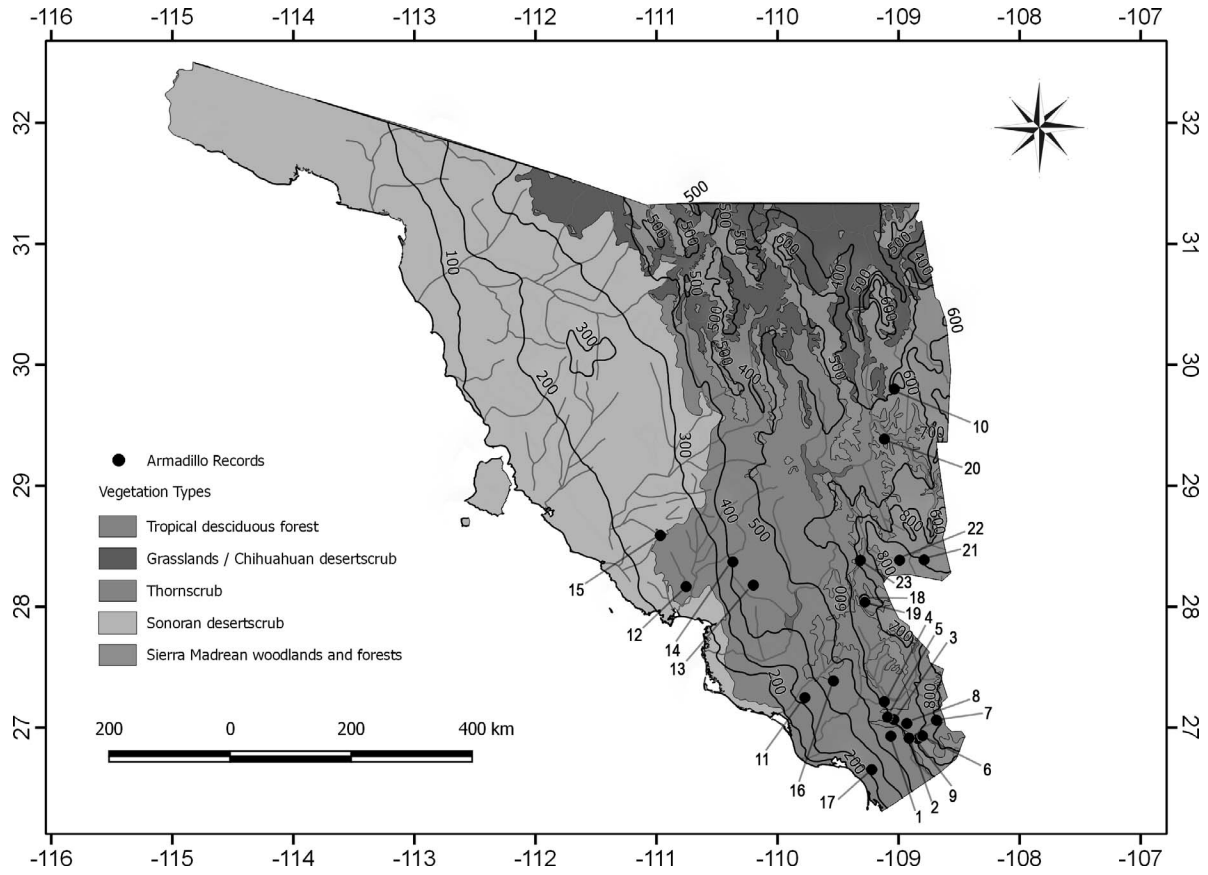

Fig. 1—Nine-banded armadillo (*Dasypus novemcinctus*) records in Sonora and their occurrence in different vegetation types. Nine-banded armadillos show preference for other vegetation types than Sonoran desertscrub. Areas with precipitation <300 mm are not occupied by nine-banded armadillos, unless they occupy riparian habitats (adjacent to canyons and rivers) or agriculture lands. Localities are numbered to correspond to Table 1.

Nine-banded armadillos are not very well known and only rarely consumed in Sonora compared with other states in Mexico; however, they are known and hunted, tanned, and stuffed in southern Sonora and in a few riparian corridors along the major rivers of Sonora. Our 23 records show northeast range extensions within the state (Fig. 1; Table 1). They have been seen or hunted in the municipalities of Álamos, Bacadéhuachi, Empalme, Guaymas, Hermosillo, Huatabampo, Rosario, Sahuaripa, and Yécora as far north as 29°48′N, as far east as −108°47′W, and west to −110°58′W. Nine-banded armadillos occur from 50 to 1,656 m above sea level. Records exist for several river basins from south to north including the Río Fuerte: Álamos, Arroyo el Mentidero, and La labor (Arroyo Álamos–Río Cuchujaqui); las Rastras (Las Bocas drainage); Río Mayo: Cuba (Río Cedros), Presa Mocúzari, and the Sierra de Álamos; Río Yaqui: Cajeme, Rancho Babisal (Río Áros), Rancho Santa Margarita, Pilares (Ríos Maycoba-Mulatos-Áros), Rancho Embudo (Ríos Bacadéhuachi-Bavispe), and Santa Ana de Yécora (Río Chico); Río Mátape (Palo Verde and La Atravesada); and Río Sonora (la Pintada). Agiabampo and Sirebambo are in local drainages between the Río Fuerte and Río Mayo.

The northern limits of the New World tropics are in Sonora, where tropical deciduous forest reaches the Sierra San Javier (28°38′N). Thornscrub (TS) is the tropical vegetation transitional biome between Sonoran desertscrub and tropical deciduous forest in southern Sonora and oak woodland in a Madrean woodland forest farther north. Foothills TS reaches its northern limit in the Arizpe area in the Río Sonora Valley (30°11′N; Van Devender et al., 2013). Armadillos live in tropical deciduous forests from the Álamos area north to Cuba and Santa Ana de Yécora. The armadillos in Cuba were in milpa (cornfields). Rancho la Laguna near Santa Ana (Yécora) is a tropical deciduous forest with patches of oak woodland on hydrothermally altered acid soil gossans (Goldberg, 1982).

Nine-banded armadillo observations occurred in coastal TS in the coastal plain of the Gulf of California in southern Sonora near Agiabampo, Cajeme, Presa Mocúzari, Rancho Santa Margarita, and Sirebampo and also in the upland foothills TS at La Atravesada and at Rancho Babisal on the northern Jaguar Reserve. The record for Rancho el Embudo in the Sierra de Bacadéhuachi is in a transition between TS and a desert grassland and oak woodland mosaic. TS extends northward to Sierra Libre and la Pintada, just east of the Sonoran desertscrub. The armadillos at Los Pilares east of Yécora in the Sierra Madre Occidental were in a riparian habitat in oak woodland

Table 1—Records of nine-banded armadillo (*Dasypus novemcinctus*) from Sonora, Mexico. Data are arranged by date and by municipality (alphabetical order).

No.	Date	Municipality	Locality	Latitude, longitude	Elevation (m)	Record	Reference or observation
1	1993	Álamos	Rancho Las Rastras	26°55.754′N, −109°03.871′W	270	Skin	Castillo-Gámez et al., 2010
2	1994	Álamos	Arroyo El Mentidero	26°54.75′N, −108°54.833′W	244	Observation	Pers. comm. to T.R.V.D.
3	1995	Álamos	Agua Marina	27°04.033′N, −109°02.417′W	467	Road kill	Pers. comm. to T.R.V.D.
4	2009	Álamos	Río Mayo	27°12.904′N, −109°07.134′W	83	Camera trap	Castillo-Gámez et al., 2010
5	2009	Álamos	Sierra de Álamos	27°05.189′N, −109°05.471′W	304	Road kill	Pers. comm. to T.R.V.D.
6	2012	Álamos	La Labor de Santa Lucía	26°55.86667′N, −108°48.2167′W	366	Camera trap	Pers. comm. to T.R.V.D.
7	2014	Álamos	Rancho Los Llanos de San Pedro	27°03.65′N, −108°41.2667′W	514	Camera trap	Pers. comm. to T.R.V.D.
8	2015	Álamos	Barrio la Estación	27°02.017′N, −108°55.95′W	398	Observation	Pers. comm. to T.R.V.D.
9	2016	Álamos	La Laborcita, SE of Álamos	26°54.56667′N, −108°50.45′W	279	Observation	Pers. comm. to T.R.V.D.
10	2016	Bacadéhuachi	Rancho el Embudo	29°47.933′N, −109°02.1834′W	1,146	Observation	Pers. comm. to T.R.V.D.
11	2005	Cajeme	Joaquín Amaro	27°14.892′N, −109°46.494′W	50	Observation	Hunted as a "rarity" J.P.G.R.
12	2003	Empalme	NW of la Atravesada	28°09.926′N, −110°45.378′W	76	Photographed	Observed by J.P.G.R.
13	2011	Guaymas	Rancho Santa Margarita	28°10.675′N, −110°12.026′W	233	Skin photographed	Pers. comm. to T.R.V.D.
14	2017	Guaymas	Río Mátape, S of Palo Verde	28.37018°N, −110.37018°W	183	Observation	J.P.G.R.
15	2012	Hermosillo	Archeological site, La Pintada	28°35.304′N, −110°58.139′W	249	Tracks, den	J.P.G.R., L.A.M., and I.D.B.A.
16	1988	Huatabampo	N of Agiabampo	27°13.548′N, −109°32.3334′W	80	Observation	Pers. comm. to T.R.V.D.
17	2016	Huatabampo	Sirebampo. Km 104, Highway 15	26°39.172′N, −109°13.376′W	54	Road kill	J.P.G.R.
18	2005	Rosario	NNW of Cuba	28°03.700′N, −109°17.043′W	412	Observation	H.C.S. and G.S.G.
19	2008	Rosario	SE of Cuba	28°02.276′N, −109°16.777′W	443	Tracks, den excavated	J.P.G.R., H.C.S., and G.S.G.
20	1984	Sahuaripa	El Bajío, Rancho Babisal	29°23.117′N −109°07.084′W	811	Skin	Pers. comm. to T.R.V.D.
21	1998	Yécora	Arroyo Los Pilares, E of Yécora	28°23.217′N, −108°47.3833′W	1,281	Killed	Pers. comm. to T.R.V.D.
22	2000	Yécora	Rancho La Laguna Tayopa	28°22.9998′N, −109°19.00′W	760	Observation	Pers. comm. to A. L. Reina-Guererro and T.R.V.D.
23	2006	Yécora	Rancho Alma Joven	28°23′03′′N, −108°59′33′′W	1,656	Skin	Castillo-Gámez et al., 2010

(Madrean woodland forest). The record at Rancho Alma Joven northwest of Yécora was also in a Madrean woodland forest. No records were from Sonoran desertscrub.

The records of nine-banded armadillos in Sonora are scattered both in time and geography, making it difficult to know whether their range is expanding in response to climatic fluctuations. Nevertheless, they are possibly in an expansion similar to that reported for the nine-banded armadillos in the United States (Taulman and Robbins, 1996). A reconstruction of their probable expansion is as follows. First records occurred from 1984 to 2016 in areas of tropical deciduous forest (11 records), followed by records to the north from 1998 to 2006 in oak woodland (Madrean woodland forest; three records). Nine-banded armadillos expanded their range into Sonoran foothill TS (four records) from 2003 to 2017 and finally to agricultural areas mixed with TS from 2005 to 2017 (five records).

These long-term observations show that the nine-banded armadillo distribution in Sonora is in a relatively large area, larger than expected for a species poorly known in the state and that went undetected by several studies. Possibly, they are restrained from covering more area of the state by environmental factors, similar to factors affecting the recent expansion of the nine-banded armadillos in the United States (Taulman and Robbins, 2014) such as high annual precipitation (40–50 cm) and cold winters (−9 to −10°C). The majority of our nine-banded armadillo records (18 of 23, 78%) are found in areas with 500 mm of annual precipitation. Three (13%) are found in areas with 300–400 mm of annual precipitation, and two (9%) are found in areas of 200–300 mm of annual precipitation; these latter five (21%) records for nine-banded armadillos were mostly from agricultural and riparian areas near Sonoran desertscrub, showing a clear effect of precipitation on their distribution in Sonora.

The nine-banded armadillo is a tropical animal that reaches its northwestern geographic limit in Sonora; it is clear that it are not common or there would be more sightings. Certainly, a great deal remains to be learned about this unique animal in the northern Neotropics.

This article is in honor of our coauthor H. Cabrera-Santiago, whose early passing inspired us to continue with his initiatives and joy of nature. We thank S. A. Meyer for providing several records of armadillos in the Álamos area and A. L. Montaño, E. Rogero (Sierra de Álamos-Río Cuchujaqui Área de Protección de Flora y Fauna), P. Holm, and B. Wirt provided several additional records. A. L. Reina-Guererro helped with fieldwork and interviews with ranchers. Records and images are available in the Madrean Discovery Expeditions database (madreandiscovery.org). We are grateful to two anonymous reviewers who helped to improve the manuscript.

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Submitted 20 July 2017. Accepted 15 March 2018.
Associate Editor was Troy Ladine.