



## Research note

# Distribution of some amphibians from central western Mexico: Jalisco

## Distribución de algunos anfibios del centro occidente de México: Jalisco

Verónica Carolina Rosas-Espinoza<sup>1</sup>, Jesús Mauricio Rodríguez-Canseco<sup>1✉</sup>, Ana Luisa Santiago-Pérez<sup>1</sup>, Alberto Ayón-Escobedo<sup>1</sup> and Matías Domínguez-Laso<sup>2</sup>

<sup>1</sup>Universidad de Guadalajara, Centro Universitario de Ciencias Biológicas y Agropecuarias, Km 15.5 carretera Guadalajara- Nogales, 45110 Zapopan, Jalisco, Mexico.

<sup>2</sup>UMA Coatzin, Prol. Piñón Núm. 39, Barrio de la Cruz. 76800 San Juan del Río, Querétaro, México.

✉jmrc2603@hotmail.com

**Abstract.** The amphibian fauna from central western Mexico has not been studied thoroughly. Particularly for the state of Jalisco, until 1994 the majority of herpetofauna checklists were made on seasonally tropical dry forest at the Pacific coast. Recently, the herpetofauna checklists for some natural protected areas and surroundings of central and northeastern localities of Jalisco were reported. Sierra de Quila is a natural protected area located in central Jalisco, and these results are part of the first formal study for this area. During 15 months, from January 2009 to September 2010, we surveyed amphibians on an altitudinal gradient including all vegetation types: cloud forest, pine-oak forest, oak forest, riparian forest and tropical deciduous forest. We registered 11 noteworthy range extensions for amphibians within Jalisco and into the Sierra de Quila.

Key words: range extension, protected area, Sierra de Quila.

**Resumen.** Los anfibios de la parte centro-occidente de México han sido poco estudiados. Particularmente para el estado de Jalisco y hasta 1994, la mayoría de los inventarios de herpetofauna fueron realizados en el bosque tropical caducifolio en la costa del Pacífico. Recientemente, se registraron las herpetofaunas de algunas áreas naturales protegidas y localidades en los alrededores del centro y noreste de Jalisco. Sierra de Quila es un área natural protegida localizada en el centro de Jalisco y estos resultados forman parte del primer estudio formal para el área. Durante 15 meses, de enero 2009 a septiembre 2010 se muestrearon anfibios en un gradiente altitudinal, incluyendo todos los tipos de vegetación; bosque mesófilo, bosque de pino-encino, bosque de encino, bosque de galería y bosque tropical caducifolio. Registramos la ampliación de la distribución conocida para 11 especies de anfibios dentro de Jalisco y en la sierra de Quila.

Palabras clave: ampliación de distribución, área protegida, sierra de Quila.

The amphibian fauna from central western Mexico has not been studied thoroughly. Particularly for the state of Jalisco, Flores-Villela and Pérez-Mendoza (2006) reported 5 publications regarding herpetofauna checklists done between 1958 and 1994, the majority of these works were carried out in seasonally tropical dry forest at the Pacific coast (Casas Andreu 1982; García y Ceballos 1994; Ramírez-Bautista 1994). Additionally, Chrapliwy et al. (1961) reported for first time in *Bufo punctatus* in northern Jalisco. Since 1995, other studies have been made, such as the study by Peterson et al. (1995) about a range extension for *Eleutherodactylus occidentalis* and

*Hyla eximia* on Chapala Lake; another study was done by Ponce-Campos et al. (2003) on the subtropical dry forest at the Barranca of Rio Santiago where they registered a range extension of *Eleutherodactylus pallidus*. During 2004, Ponce-Campos and Ortega-Huerta reported the herpetofauna from Guadalajara City and its surrounding area. Loeza-Corichi (2004) conducted a study on the species richness of amphibians and reptiles in an altitudinal gradient in Cerro Grande, Sierra de Manantlán Biosphere Reserve. On 2006, Riojas-López and Mellink registered the herpetofauna in shrubland and cultivated stands at the Mexican Plateau. Ponce-Campos and Beaman (2006) reported a distribution expansion of *Eleutherodactylus angustidigitum* at the municipality of Tuxpan near Atenuique, before this species was reported by Dixon

and Heyer (1966) in another site near Atenquique and by Webb (1964) near Concepción de Buenos Aires. Recently, several authors have reported the herpetofauna checklists of 3 protected areas. These areas including the following dominant vegetation types: La Primavera, with temperate forest (pine-oak) and tropical deciduous forest (Reyna-Bustos et al. 2007), Las Joyas Research Station in Sierra de Manantlán; temperate forest (pine-oak) and cloud forest (Orozco-Urbe 2009) and Barranca del Río Santiago; a tropical deciduous forest (Cruz-Saénz et al. 2008), respectively. Suazo-Ortuño et al. (2011) stated that the importance of riparian areas for the conservation of herpetofauna in tropical dry forests varies with forest condition, season and with the particular herpetological assemblages at the Chamela Biosphere Reserve and surrounding agricultural areas along the Pacific coast of Jalisco State. Cruz-Saénz et al. (2011) updated the checklist of an oak forest located at northeast Guadalajara City in Huaxtla, municipality of Zapopan, and Flores-Cobarrubias et al. (2012) after 6 months of fieldwork registered 60 herpetofauna species at Hostotipaquillo municipality.

Sierra de Quila is a natural protected area located on central Jalisco (20°14'29"-20°21'37" N, 103°56'49"-104°07'53" W). During 15 months, from January 2009 to September 2010 we surveyed amphibians in an altitudinal gradient including all vegetation types: cloud forest, pine-oak forest, oak forest, riparian forest and tropical deciduous forest (Fig. 1). We registered 11 noteworthy range extensions for amphibians within Jalisco State and in Sierra de Quila.

We collected 2 adults of *Incilius marmoratus*, 8 adults of *Craugastor occidentalis*, 1 adult of *Plectrohyla bistincta*, 1 adult of *Smilisca baudinii*, 2 adults of *Lithobates neovolcanicus* and 2 neotenic and 1 adult of *Ambystoma flavipiperatum* in Sierra de Quila. All these specimens are deposited in the Herpetological Collection of the Zoological Museum Alfonso L. Herrera, Facultad de Ciencias, Universidad Nacional Autónoma de México (MZFC). Additionally, we took pictures of 1 adult of *Craugastor hobartsmithi*, 1 adult of *Craugastor pygmaeus*, 1 adult of *Eleutherodactylus angustidigitorum* and 1 adult of *Lithobates forreri* and these were deposited in the University of Texas at Arlington Digital Collection (UTADC). We have only a photograph of *Leptodactylus melanotus in situ* (Santiago-Pérez et al. 2012). Collected specimens and pictures were part of a formal study conducted at the protected area Sierra de Quila, Jalisco, México (Rodríguez-Canseco, 2012; Matías Domínguez-Laso Scientific Collecting License Number FAUT-0243). The identification of specimens was verified by MSc. Edmundo Pérez-Ramos at the MZFC and Jacobo Reyes-

Velasco at the Department of Biology, University of Texas at Arlington.

#### Caudata

*Ambystoma flavipiperatum* (yellow-peppered salamander). Sierra de Quila (20°16'42"N, 104°05'05" W), 2 130 m elevation, municipality of Tecolotlán, Jalisco, México, near Tecolotlán town, 100 km SW of Guadalajara City. 5 January 2009. Col. Jesús Mauricio Rodríguez-Canseco and Matías Domínguez-Laso. Species verified by Edmundo Pérez-Ramos, MZFC 25638-40.

Many individuals were found in slow moving and not very deep streams in Sierra de Quila. These streams had a lot of organic matter in decomposition (oak leaves and pine needles) on the bottom of the stream. All the streams were bordered by riparian forest and adjacent to this was pine-oak forest at an elevation between 1 800-2 300 m. This salamander is only known from the locality of Santa Cruz, 26 miles southwest of Tapalpa, Jalisco, found by Dixon (1963) on desert shrub and dense thorn forest along temporary streams. Sierra de Quila is located about 48 km NW of the previously reported locality near Tapalpa, Jalisco. The adult individual was a male with a total length= 133.6 mm, snout-vent length= 66.2 mm, head width= 16.2 mm, head length= 22.6 mm, interorbital distance= 7.7 mm, internarial distance= 6.4 mm, length of forelimb= 22.3 mm, length of hindlimb= 25.7 mm and costal grooves= 13. This individual was smaller than the holotype reported by Dixon (1963). At Santa Cruz, he found only an adult male with a total length of 175.0 mm; snout-vent length of 99.5 mm; head width of 19.5 mm; head length of 25.0 mm; interorbital distance of 9.0 mm; internarial distance of 7.8 mm; length of forelimb of 28.2 mm and length of hindlimb of 32.2 mm. In Sierra de Quila, the neotenic individuals collected were a female and a male. The male had a total length of 173.6 mm; snout-vent length of 83.6 mm; head width of 15.87 mm; head length of 20.84 mm; interorbital distance of 7.09 mm; internarial distance of 4.43 mm; length of forelimb of 30.8 mm and the length of hindlimb of 33.6 mm. The female had a total length of 154.7 mm; snout-vent length of 77.7 mm; head width of 15.17 mm; head length of 22.99 mm; interorbital distance of 6.13 mm; internarial distance of 5.05 mm; length of forelimb of 24.8 mm and length of hindlimb of 27.6 mm. Both individuals had 12 costal grooves. Dixon (1963) did not report any measurements of neotenic individuals.

#### Anura

*Incilius marmoratus* (marbled toad). Sierra de Quila (20°15'37" N, 104°06'04" W), 1 350 m elevation, municipality of Tecolotlán, Jalisco, Mexico, near

Tecolotlán town, 100 km SW of Guadalajara City. 01 July 2010. Col. Jesús Mauricio Rodríguez-Canseco and Matías Domínguez-Laso. Specimen verified by Edmundo Pérez-Ramos, MZFC 25628-29. The toads were found active in tropical deciduous forest during a rainy night. They were jumping along the road and a temporal stream was nearby. In Jalisco, this toad is only known from the coastal area (Casas-Andreu, 1982; García and Ceballos, 1994; Ramírez-Bautista, 1994; Santos-Barrera et al., 2010a); its most eastern record is from the locality of La Resolana, Jalisco (HerpNet, 2010a). It is associated with tropical sub deciduous forest, tropical deciduous forest and riparian forest (Casas-Andreu, 1982; García and Ceballos, 1994; Ramírez-Bautista, 1994). Sierra de Quila represents a distribution range extension of at least 81 km from the Pacific coast distribution through Jalisco east bound.

*Craugastor hobartsmithi* (Smith's pigmy robber frog). Sierra de Quila (20°16'46" N, 104°03'09" W), 1 800 m elevation, municipality of Tecolotlán, Jalisco, México, near Tecolotlán town, 100 km SW of Guadalajara City. 17 January 2009. Col. Jesús Mauricio Rodríguez-Canseco. University of Texas at Arlington Digital Collection (UTADC-7567-7568). Specimen verified by Jacobo Reyes-Velasco. Several individuals were registered in riparian forest surrounded by oak pine forest. According to Santos-Barrera and Flores-Villela (2004), this species is distributed from the south western portion of the Mexican plateau, Nayarit and Jalisco westward into Michoacán and eastern State of México. There are 4 localities previously reported: 1 from Jalisco, 2 from Michoacán and 1 from Estado de México. In Jalisco, it was reported on the surroundings of Guadalajara City (Ponce-Campos and Huerta-Ortega, 2004; Santos-Barrera and Flores-Villela, 2004). Although, it is known from the coast of Jalisco in Chamela (García and Ceballos, 1994) and the surrounding areas (Instituto de Biología, 2005a, 2005b), in Autlán (HerpNet, 2010b) and La Primavera (Reyna-Bustos et al., 2007). Sierra de Quila is at least 62 km from Autlán and 67 km from La Primavera.

*Craugastor occidentalis* (Taylor's barking frog). Sierra de Quila (20°15'38" N, 104°03'59" W) 1 598 m elevation, municipality of Tecolotlán, Jalisco, Mexico, near Tecolotlán town, 100 km SW of Guadalajara City. 31 May 2011. Col. Jesús Mauricio Rodríguez-Canseco. Specimen verified by Edmundo Pérez-Ramos, MZFC 25648, 25649, 25652, 25658, 25659, 25662, 25666, 25667. We registered several individuals in tropical deciduous forest jumping along a road on one field trip. Additionally, this species was found in pine oak forest in between leaf litter and rocks. According to Santos-Barrera and Canseco-Márquez (2004a), this frog is reported in western Mexico: Sinaloa, Nayarit, Jalisco and Michoacán. Particularly for Jalisco,

it is registered on 3 sites: Manantlán (Santos-Barrera and Canseco-Márquez, 2004a), Chapala (Peterson et al., 1995, Santos-Barrera and Canseco-Márquez, 2004a) and one in the very eastern portion of the state (Santos-Barrera and Canseco-Márquez, 2004a). Although, it is also registered on Jalisco state in several localities on the coast (García and Ceballos, 1994; Instituto de Biología, 2005c, 2005d), in the central part (Ponce-Campos y Huerta-Ortega, 2004; Instituto de Biología, 2005e; Reyna-Bustos et al., 2007; Cruz-Sáenz et al., 2011) and in the northern part (HerpNet, 2010c; Flores-Cobarrubias et al., 2012). The nearest previous known locality was La Primavera (Reyna-Bustos et al., 2007). This species seems to be widely distributed in Jalisco State.

*Craugastor pygmaeus* (pygmy robber frog). Sierra de Quila (20°18'38" N, 104°03'21" W), 1 900 m elevation, municipality of Tecolotlán, Jalisco, Mexico, near Tecolotlán town, 100 km SW of Guadalajara City. 25 September 2010. Col. Jesús Mauricio Rodríguez-Canseco and Matías Domínguez-Laso. University of Texas at Arlington Digital Collection (UTADC-7569-7570). Specimen verified by Jacobo Reyes-Velasco. This individual was found during the day in a riparian forest surrounded by oak and pine forest. It was sighted near El Ahogado stream, among the leaf litter. Additionally, it was registered near streams in tropical deciduous forest. This frog is known to occur from extreme southern Michoacán and central and southeast State of México (Santos-Barrera and Canseco-Márquez, 2004b; Canseco and Gutiérrez, 2010), north Puebla state, Veracruz (Taylor, 1936; Santos-Barrera and Canseco-Márquez, 2004b; Canseco-Márquez and Gutiérrez-Mayén 2006; Canseco and Gutiérrez, 2010), Oaxaca (Santos-Barrera and Canseco-Márquez, 2004b) and south and east along the Pacific slope to western Guatemala (Santos-Barrera and Canseco-Márquez, 2004b). Recently, it was registered on the south western area of Jalisco State on Sierra de Manantlán, 25 km SE Autlán (Orozco-Uribe, 2009). Sierra de Quila is a distribution range extension for this species of about 83 km to NE of Sierra de Manantlán.

*Plectrohyla bistrincta* (Mexican fringe limbed treefrog). Sierra de Quila (20°18'43" N, 104°03'32" W), 2 100 m elevation, municipality of Tecolotlán, Jalisco, Mexico, near Tecolotlán town, 100 km SW of Guadalajara City. 15 April 2010. Col. Jesús Mauricio Rodríguez-Canseco and Matías Domínguez-Laso. Specimen verified by Edmundo Pérez-Ramos, MZFC 25669. One active female was found during the night in a riparian forest surrounded by oak-pine forest and next to a stream. This species has been reported in higher elevations in the Sierra Madre Occidental of Mexico, from Durango and adjacent Sinaloa and to the east in the central Volcanic Belt to Hidalgo and Puebla

(Santos-Barrera and Canseco-Márquez, 2004c), Veracruz (Canseco and Gutiérrez, 2010), as well as, in Michoacán, Guerrero and Oaxaca (Altig, 1964; Santos-Barrera and Canseco-Márquez, 2004c). Although, this species is claimed to be present throughout the central part of Jalisco at high elevations (Santos-Barrera and Canseco-Márquez, 2004c), it has been only registered in the southwestern portion of the state of Jalisco, in the Sierra de Manantlán, 25 km, SE Autlán and associated to streams (Duellman 1964; Orozco-Urbe 2009). Sierra de Quila represents a distribution range extension of about 83 km NE of Sierra de Manantlán.

*Smilisca baudinii* (Mexican treefrog) Sierra de Quila (20°15'37" N, 104°06'04" W), 1 350 m elevation, municipality of Tecolotlán, Jalisco, Mexico, near Tecolotlán town, 100 km SW of Guadalajara City. 1 July 2010. Col. Jesús Mauricio Rodríguez-Canseco and Matías Domínguez-Laso. Specimen verified by Edmundo Pérez-Ramos, MZFC 25647. One organism was found dead on the road near a stream in riparian forest surrounded by tropical deciduous forest. The geographic range of this species is along the Atlantic and Pacific versants. On the Pacific, it occurs from southern Sonora southward to Oaxaca (Santos-Barrera et al., 2010). In Jalisco, it was registered in several localities on the coast (García and Ceballos, 1994; HerpNet, 2010d). Later, it was registered in the surroundings of Guadalajara (Ponce-Campos y Huerta-Ortega, 2004) and at La Primavera (Reyna-Bustos et al., 2007). Sierra de Quila is a range extension of at least 140 km of its previously known distribution on the Jalisco coast.

*Leptodactylus melanonotus* (tropical frog). Sierra de Quila (20°14'54" N, 104°03'24" W), 1 326 m elevation, municipality of Tecolotlán, Jalisco, Mexico, near Tecolotlán town, 100 km SW of Guadalajara City. 15 April 2010. Col. Jesús Mauricio Rodríguez-Canseco and Matías Domínguez-Laso. Several organisms were observed in tropical deciduous forest near stream. This species is distributed in Mexico from southern Tamaulipas on the Atlantic slope, and from southern Sonora on the Pacific slope (Solis et al., 2010). In Jalisco State, it is known from the coast (García and Ceballos, 1994; Solis et al., 2008, HerpNet, 2010e). In 2007, it was reported in an eastern locality: La Primavera (Reyna-Bustos et al., 2007). Sierra de Quila is a range extension of at least 70 km of its previous distribution reports on the Jalisco coast. There is only one photograph of this species (Santiago-Pérez et al. 2012).

*Lithobates neovolcanicus* (transverse volcanic leopard frog). Sierra de Quila (20°14'54" N, 104°03'24" W), 1 326 m elevation, municipality of Tecolotlán, Jalisco, Mexico, near Tecolotlán town, 100 km SW of Guadalajara City. 15

April 2010. Col. Jesús Mauricio Rodríguez-Canseco and Matías Domínguez-Laso. Specimen verified by Edmundo Pérez-Ramos, MZFC 25632, 25633. We found many active individuals jumping on the grass near the Santa Rosa stream. This species is known from south eastern Jalisco, northern Michoacán and southern Guanajuato (Santos-Barrera and Flores-Villela, 2004). In Jalisco, this species was described from 3.2 km NW Tapalpa. Additionally, it is known from Chapala and surroundings (Hillis and Frost, 1985, HerpNet, 2010f), near Guadalajara (Ponce-Campos and Huerta-Ortega, 2004), La Primavera (Reyna-Bustos et al., 2007) and 64 km NW Ciudad Guzmán (Hillis and Frost, 1985). Sierra de Quila is located 45 km NW from Tapalpa.

*Eleutherodactylus angustidigitorum* (Pátzcuaro stream frog) Sierra de Quila (20°18'44.5" N, 104°00'48.2" W) 2 450 m elevation, municipality of Tecolotlán, Jalisco, Mexico, near Tecolotlán town, 100 km SW of Guadalajara City. September 25, 2010. Col. Jesús Mauricio Rodríguez-Canseco and Matías Domínguez-Laso. University of Texas at Arlington Digital Collection (UTADC- 7486, 7487, 7488). Specimen verified by Jacobo Reyes-Velasco. Individuals were found either under rocks or active upon the rocks inside pine-oak forest in plain sunlight. Another individual was found active, during the day, on oak-pine leaf litter, near a permanent stream. Historically, this species ranged within a wide area in Michoacán, but it is now restricted to north-western and central Michoacán at around 1 500 m elevation. Other localities are reported in Jalisco: the northern part of Nevado de Colima, Mazamitla (Santos-Barrera and Canseco-Márquez 2004d), municipality of Tuxpan near Atenquique and Concepción de Buenos Aires (Ponce-Campos and Beaman 2006). Our record in Jalisco is a range extension of 88 km from its nearest reported locality in Nevado de Colima.

*Lithobates forreri* (Forrer's grass frog) Sierra de Quila (20°14'11.1" N, 104°04'52.4" W) 1 320 m elevation municipality of Tecolotlán, Jalisco, Mexico, near Tecolotlán town, 100 km SW of Guadalajara City. October 13 2011. Col. Jesús Mauricio Rodríguez-Canseco and Matías Domínguez-Laso. University of Texas at Arlington Digital Collection (UTADC- 7490). Verified by Jacobo Reyes-Velasco. One organism was found active on a rainy night, 10 m from a permanent stream in tropical deciduous forest. This species is widely distributed from southern Sonora and all along the pacific coast to northern Costa Rica (Santos-Barrera et al., 2004). Although there are 2 reports in northern Jalisco, in Huaxtla and Presa de Arcediano at Barranca del Río Santiago (Cruz-Saénz et al., 2008; Cruz-Saenz et al., 2011), this record represents a range extension of 90 km from its previous known locality in Cerro Grande, Manantlán, Colima (Loeza-Corichi, 2004) to the south and



103 km from the reported northern localities, filling the gap between these 2 localities.

We wish to thank the Comité Regional de Sierra de Quila A.C.; to the ejidos and protected area staff Sierra de Quila, for the facilities provided for this study. This work was done with financial resources from Secretaría de Desarrollo Rural del Estado de Jalisco (SEDER) through the Comité Regional de Sierra de Quila A.C. We also express gratitude to Rafael Sevilla and Candelario Calderón for their valuable guidance on field. To Uri Omar García-Vázquez for allowing the use of his collecting permit (FAUT-0243); Oscar Flores-Villela and Edmundo Pérez-Ramos gave us technical support. Two anonymous reviewers and Robert Cushman improved this manuscript.

#### Literature cited

- Altig, R. 1964. Noteworthy records of anurans from Mexico. *Herpetologica* 20:210-211.
- Casas-Andreu, G. 1982. Anfibios y reptiles de la costa suroeste del estado de Jalisco, con aspectos sobre su ecología y biogeografía. Tesis doctoral, Facultad de Ciencias, Universidad Nacional Autónoma de México. México, D. F. 316 p.
- Canseco-Márquez, L. and M. G. Gutiérrez-Mayén. 2006. Herpetofauna del Municipio de Cuetzalan del Progreso, Puebla. *In* Inventarios Herpetofaunísticos de México: alcances en el conocimiento de su biodiversidad, A. Ramírez-Bautista, L. Canseco-Márquez y F. Mendoza-Quijano (eds.). Publicaciones de la Sociedad Herpetológica Mexicana, No. 3. Sociedad Herpetológica Mexicana A. C., México, D. F. p. 180-196.
- Canseco, M. L. and M. M. Gutiérrez M. 2010. Anfibios y reptiles del Valle de Tehuacán-Cuicatlán. Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, Fundación para la Reserva de la Biosfera Cuicatlán A. C., Benemérita Universidad Autónoma de Puebla. México. 302 p.
- Chrapliwy, P. S., K. Williams and H. M. Smith. 1961. Noteworthy records of amphibians from Mexico. *Herpetologica* 17:85-90.
- Cruz-Saénz, D., C. E. Gudiño-Larios, C. D. Jimeno-Sevilla, R. López-Velázquez and J. Cortés-Aguilar. 2008. Guía de anfibios y reptiles de Arcediano. Gobierno de Jalisco. Comisión Estatal del Agua. Guadalajara, Jalisco, México. 126 p.
- Cruz-Sáenz, D., D. Lazcano and L. Ontiveros-Esqueda. 2011. Notes on the herpetofauna of western Mexico 5: an update of herpetofauna in the oak forest of Huaxtla, Zapopan, Jalisco, Mexico. *Bulletin of the Chicago Herpetological Society* 46:81-87.
- Dixon, J. R. 1963. A new species of salamander of the genus *Ambystoma* from Jalisco, Mexico. *Copeia* 1963:99-101.
- Duellman, W. E. 1964. A review of the frogs of the *Hyla bistincta* group. University of Kansas Publications of the Museum of Natural History 15:469-491.
- Flores-Cobarrubias, E., D. Lazcano and D. Cruz-Sáenz. 2012. Notes on the herpetofauna of western Mexico 6: amphibians and reptiles of Hostotipaquillo, Jalisco, Mexico. *Bulletin of the Chicago Herpetological Society* 47:21-26.
- Flores-Villela, O. and H. A. Pérez-Mendoza. 2006. Herpetofaunas estatales de México. *In* Inventarios herpetofaunísticos de México: avances en el conocimiento de su biodiversidad, A. Ramírez-Bautista, L. Canseco-Márquez y F. Mendoza-Quijano (eds.). Publicaciones de la Sociedad Herpetológica Mexicana, No. 3. p. 327-346.
- García, A. y G. Ceballos. 1994. Guía de campo de los reptiles y anfibios de Jalisco, México. Fundación Ecológica de Cuixmala, A. C., Instituto de Biología, Universidad Nacional Autónoma de México. México, D. F. 184 p.
- HerpNet. 2010a. *Bufo marmoratus*. HerpNet2 data portal. Online: <http://www.herpnet.org>; last access: 13.VII.2011: California Academy of Sciences (CAS) - CAS Herpetology Collection Catalog, Field Museum - FMNH Herpetology Collections, Michigan State University Museum (MSUM) - Vertebrate specimens, Museum of Natural Science (LSUMZ) - Herp specimens, Texas Cooperative Wildlife Collection (TCWC) - TCWC Herpetology Collection, University of Arizona Museum of Natural History - Herpetology Collection, University of Kansas Biodiversity Institute - Herpetology Collection, University of Texas at El Paso - Herps Specimens.
- HerpNet. 2010b. *Eleutherodactylus hobartsmithi*. HerpNet2 data portal. Online: <http://www.herpnet.org>; last access: 13.VII.2011: Texas Cooperative Wildlife Collection (TCWC) - TCWC Herpetology Collection, University of Kansas Biodiversity Institute - Herpetology Collection.
- HerpNet. 2010c. *Eleutherodactylus occidentalis*. HerpNet2 data portal. Online: <http://www.herpnet.org>; last access: 13.VII.2011: California Academy of Sciences (CAS) - CAS Herpetology Collection Catalog, Michigan State University Museum (MSUM) - Vertebrate specimens, University of Kansas Biodiversity Institute - Herpetology Collection, University of Texas at El Paso - Herps Specimens.
- HerpNet. 2010d. *Smilisca baudinii*. HerpNet2 data portal. Online: <http://www.herpnet.org>; last access: 13.VII.2011: California Academy of Sciences (CAS) - CAS Herpetology Collection Catalog, Field Museum - FMNH Herpetology Collections, Museum of Natural Science (LSUMZ) - Herp specimens, Texas Cooperative Wildlife Collection (TCWC) - TCWC Herpetology Collection, University of Kansas Biodiversity Institute - Herpetology Collection.
- HerpNet. 2010e. *Leptodactylus melanonotus*. HerpNet2 data portal. Online: <http://www.herpnet.org>; last access: 13.VII.2011: Arctos - MVZ Herp Catalog, California Academy of Sciences (CAS) - CAS Herpetology Collection Catalog, Field Museum - FMNH Herpetology Collections, Florida Mus Nat Hist (UF) - Herpetology specimens, Michigan State University Museum (MSUM) - Vertebrate specimens, Museum of Natural Science (LSUMZ) - Herp specimens, University of Kansas Biodiversity Institute -

- Herpetology Collection, University of Texas at El Paso - Herps Specimens.
- HerpNET. 2010f. *Rana neovolcanica*. HerpNet2 data portal. Online: <http://www.herpnet.org>; last access: 13.VII.2011: Arctos - MVZ Herp Catalog, Texas Cooperative Wildlife Collection (TCWC) - TCWC Herpetology Collection, University of Colorado Museum of Natural History - CUMNH Herpetology Collection, University of Kansas Biodiversity Institute - Herpetology Collection.
- Hillis, D. M. and J. S. Frost. 1985. Three new species of Leopard Frogs (*Rana pipiens* Complex) from The Mexican Plateau. Occasional Papers of the Museum of Natural History University of Kansas 117:1-14.
- Instituto de Biología. 2005a. *Eleutherodactylus hobartsmithi* Taylor- IBUNAM:CNAR:AR6771. Universidad Nacional Autónoma de México. Online: <http://www.unibio.unam.mx/collections/specimens/urn/IBUNAM:CNAR:AR6771>; last access: 13.VII.2011.
- Instituto de Biología. 2005b. *Eleutherodactylus hobartsmithi* Taylor- IBUNAM:CNAR:AR6770. Universidad Nacional Autónoma de México. Online: <http://www.unibio.unam.mx/collections/specimens/urn/IBUNAM:CNAR:AR6770>; last access: 13.VII.2011.
- Instituto de Biología. 2005c. *Eleutherodactylus occidentalis* Taylor- IBUNAM:CNAR:AR6791". Universidad Nacional Autónoma de México. Online: <http://www.unibio.unam.mx/collections/specimens/urn/IBUNAM:CNAR:AR6791>; last access: 13.VII.2011.
- Instituto de Biología. 2005d. *Eleutherodactylus occidentalis* Taylor- IBUNAM:CNAR:AR8320". Universidad Nacional Autónoma de México. Online: <http://www.unibio.unam.mx/collections/specimens/urn/IBUNAM:CNAR:AR8320>; last access: 13.VII.2011.
- Instituto de Biología. 2005e. *Eleutherodactylus occidentalis* Taylor- IBUNAM:CNAR:AR8319". Universidad Nacional Autónoma de México. Online: <http://www.unibio.unam.mx/collections/specimens/urn/IBUNAM:CNAR:AR8319>; last access: 13.VII.2011.
- Loeza-Corichi, A. 2004. Caracterización altitudinal de la herpetofauna en la región de Cerro Grande, Reserva de la Biosfera Sierra de Manantlán, Jalisco-Colima. Tesis maestría, Facultad de Ciencias, Universidad Nacional Autónoma de México. México, D. F. 88 p.
- Orozco-Uribe, L. C. 2009. Herpetofauna de la estación científica Las Joyas en la Reserva de la Biosfera Sierra de Manantlán, Jalisco, México: guía ilustrada y claves para su determinación. Tesis. Centro Universitario de Ciencias Biológicas y Agropecuarias, Universidad de Guadalajara. Zapopan, Jalisco. 86 p.
- Peterson, H. W., H. M. Smith and D. Chiszar. 1995. Some noteworthy amphibians and reptiles from the region of Chapala, Jalisco, Mexico. Bulletin of the Chicago Herpetological Society 30:90-91.
- Ponce-Campos, P., S. M. Huerta-Ortega, A. Heinze-Yothers and H. M. Smith. 2003. Range extensions and variational notes on some amphibians and reptiles of Jalisco and Michoacán, Mexico. Bulletin of the Maryland Herpetological Society 39:1-7.
- Ponce-Campos, P. and S. M. Huerta-Ortega. 2004. Anfibios y reptiles de la zona conurbana de Guadalajara y su periferia. In *Ecología urbana en la zona metropolitana de Guadalajara*, G. A. López-Coronado y J. J. Guerrero-Nuño (eds.). Editorial Ágata, Guadalajara, Jalisco. p. 219-256.
- Ponce-Campos, P. and K. Beaman. 2006. Geographic Distribution. *Eleutherodactylus angustidigitorum*. Herpetological Review 37:237.
- Ramírez-Bautista, A. 1994. Manual y claves ilustradas de los anfibios y reptiles de la región de Chamela, Jalisco, México. Cuadernos 23, Instituto de Biología, UNAM. México, D.F. 127 p.
- Reyna-Bustos, O. F., I. T. Ahumada-Carrillo and O. Vázquez-Huizar. 2007. Anfibios y reptiles del bosque La Primavera: guía ilustrada. Universidad de Guadalajara, Gobierno del Estado de Jalisco. Guadalajara, Jalisco, México. 125 p.
- Riojas-López, M. E. and E. Mellink. 2006. Herpetofauna del rancho Las Papas, Jalisco, Llanuras de Ojuelos-Aguascalientes, México. Acta Zoológica Mexicana 22:85-94.
- Rodríguez-Canseco, J. M. 2012. Diversidad de anfibios y reptiles en un gradiente altitudinal del Área de Protección de Flora y Fauna Sierra de Quila. Tesis. Centro Universitario de Ciencias Biológicas y Agropecuarias, Universidad de Guadalajara. Zapopan, Jalisco. 117 p.
- Santiago-Pérez, A. L., M. Domínguez-Laso, V. C. Rosas-Espinoza y J. M. Rodríguez-Canseco (Coords.) 2012. Anfibios y Reptiles de las montañas de Jalisco: Sierra de Quila. Universidad de Guadalajara/ Comisión Nacional para el Conocimiento y Uso de la Biodiversidad/ Coatzin, A. C./ Sociedad Herpetológica Mexicana, A. C. Guadalajara, Jalisco. 227 p.
- Santos-Barrera, G. and L. Canseco-Márquez. 2004a. *Craugastor occidentalis*. IUCN Red List of Threatened Species. Version 2012.1. Online: <http://www.iucnredlist.org>; last access: 26.IX.2012.
- Santos-Barrera, G. and L. Canseco-Márquez. 2004b. *Craugastor pygmaeus*. IUCN Red List of Threatened Species. Version 2012.1. Online: <http://www.iucnredlist.org>; last access: 26.IX.2012.
- Santos-Barrera, G. and L. Canseco-Márquez. 2004c. *Plectrohyla binstincta*. IUCN Red List of Threatened Species. Version 2012.1. Online: <http://www.iucnredlist.org>; last access: 26.IX.2011.
- Santos-Barrera, G. and L. Canseco-Márquez. 2004d. *Eleutherodactylus angustidigitorum*. IUCN Red List of Threatened Species. Version 2012.1. Online: <http://www.iucnredlist.org>; last access: 26.IX.2012.
- Santos-Barrera, G. and O. Flores-Villela. 2004. *Craugastor hobartsmithi*. IUCN Red List of Threatened Species. Version 2012.1. Online: <http://www.iucnredlist.org>; last access: 26.IX.2012.
- Santos-Barrera, G. and O. Flores-Villela. 2004. *Lithobates neovolcanicus*. IUCN Red List of Threatened Species.

- Version 2012.1. Online: <http://www.iucnredlist.org>; last access: 26.IX.2012.
- Santos-Barrera, G., G. Chaves, J. Savage, L. D. Wilson y F. Bolaños 2004. *Lithobates forreri*. IUCN Red List of Threatened Species. Version 2012.1. Online: <http://www.iucnredlist.org>, last access: 26.IX.2012.
- Santos-Barrera, G., A. Muñoz A. and P. Ponce-Campos. 2010. *Incilius marmoreus*. IUCN Red List of Threatened Species. Version 2012.1. Online: <http://www.iucnredlist.org>; last access: 26.IX.2012.
- Santos-Barrera, G., G. Hammerson, G. Chaves, L. D. Wilson, F. Bolaños and P. Ponce-Campos. 2010. *Smilisca baudinii*. IUCN Red List of Threatened Species. Version 2012.1. Online: <http://www.iucnredlist.org>, last access: 26.IX.2012.
- Solís, F., R. Ibáñez, G. Santos-Barrera, J. Lee, J. Savage, T. Grant, A. Almendáriz, F. Bolaños, G. Chaves and P. Ponce-Campos. 2010. *Leptodactylus melanonotus*. IUCN Red List of Threatened Species. Version 2011.2. Online: <http://www.iucnredlist.org>, last access: 26.IX.2012.
- Suazo-Ortuño, I., J. Alvarado-Díaz and M. Martínez-Ramos. 2011. Riparian areas and conservation of herpetofauna in a tropical dry forest in western Mexico. *Biotropica* 43:237-245.
- Taylor, E. H. 1936. New species of amphibian from Mexico. *Transactions of the Kansas Academy of Science* 39:349-363.