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***Sceloporus immucronatus* Smith, 1936 (Squamata: Sauria) and related species from Veracruz, México.**

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Resumen: Las lagartijas espinosas con collar nuchal negro que bordea las líneas de luz que contrastan profundamente, que pertenecen al grupo *torquatus* de *Sceloporus* que se encuentra en el noreste en elevaciones inferiores (<1500 m snm), en el verso al Golfo de México desde México, aparentemente están mal identificadas. Aquí traté de despejar tal controversia mediante el examen de los caracteres de diagnóstico (colidosis), la distribución geográfica de las especies probadas aquí, y la revisión de imágenes (incluidos tanto el material tipo como los especímenes vivos), y sigo el método de Hillis para delimitar especies sexuales (Hillis, 2019). Sugiero cuatro especies completas (excepto *S. cyanogenys* consideradas como especies válidas por otros autores), *S. cariniceps*, *S. erythrocyaneus*, *S. immucronatus* y *S. plioporus*, todas ellas en esa área; pero *S. erythrocyaneus* y *S. immucronatus* en las tierras altas por encima de las elevaciones (> 1500 m snm) de la Sierra Madre Oriental y la meseta mexicana. Asimismo, informo sobre nuevas especies de registros estatales: en Hidalgo uno (*S. cariniceps*), en Veracruz tres (*S. cariniceps*, *S. cyanogenys*, *S. immucronatus*), e incluyo una clave para las especies cubiertas en este documento.

Palabras clave: método de Hillis, especies completas, alopatría, simpatría, parapatría, *Sceloporus*, grupo *torquatus*.

Abstract: The Spiny lizards with black nuchal collar bordering light lines contrasting deeply, belonging to *torquatus* group of *Sceloporus* found in northeastern in below elevations (<1500 m asl), in the versant to Mexico Gulf from México are apparently misidentified. Herein I tried of clear such controversy by examination of diagnostic characters (pholidosis), geographic distribution of the species tried here, and reviewing images (including both type material and living specimens), and I follow the Hillis' method for delimiting sexual species (Hillis, 2019). I suggest four full species (except *S. cyanogenys* considering as valid species by another authors), *S. cariniceps*, *S. erythrocyaneus*, *S. immucronatus* and *S. plioporus* all range in such area; but *S. erythrocyaneus* and *S. immucronatus* at highland above elevations (>1500 m asl) of Sierra Madre Oriental and Mexican Plateau. Likewise I report new state records species: in Hidalgo one (*S. cariniceps*), in Veracruz three (*S. cariniceps*, *S. cyanogenys*, *S. immucronatus*), and I include a key to the species covered herein.

Keywords: Hillis' method, full species, allopatry, sympatry, parapatry, *Sceloporus*, *torquatus* group.

INTRODUCTION

The taxonomy of some one lizards of the genus *Sceloporus* found in eastern and northeastern of México is controversial. The species in this region, belong to the *torquatus* group (*sensu lato*) and *poinsettii* group, which are divided (among others) in five complexes: *jarrovii*, *minor*, *poinsettii*, *serrifer* and *torquatus*, respectively. Several populations of *Sceloporus* in the states of Hidalgo, San Luis Potosí, Veracruz, and Tamaulipas, and adjacent states of county appear to be misidentified. Such problem is involucrate in the first request to several empirical and taxonomic levels (species complex, species group, species and subspecies), those populations are including in such categories, in each case (fide Smith, 1936b; Chrapliwy, 1964; Olson, 1987 and 1990; Wiens & Reeder, 1997; Wiens *et al.*, 1999; Köhler & Heimes, 2002; Martínez-Méndez & Méndez-de la Cruz, 2007; Leaché *et al.*, 2016; Lambert *et al.*, 2019, respectively).

Although several phylogenies exist for Mexican *Sceloporus* (Wiens *et al.*, 1999, Martínez-Méndez & Méndez-de la Cruz, 2007; Leaché *et al.*, 2016), none include the four species tried here (*sensu lato*); therefore the phylogeny relationships among these species remain unknown. In the former authors they suggest as nearest relative species to *S. erythrocyaneus* and *S. immucronatus*; in the following they suggest *S. cyanogenys* and *S. pliopus* as nearest relative species; meanwhile later depending of the use technical, they propose two clades with nearest relationship assessment always to *S. cyanogenys* with different topology; however, without that three studies considering apparently to by example the species *S. cariniceps*, respectively.

The saxicolous lizard *S. torquatus minor* (a highland form) was described by (Cope, 1885) from Zacatecas, Zacatecas, México on the basis of an adult male specimen UMMZ 77275 (SVL 88.5 mm). However, the paralectotype USNM 26166, and lectotype USNM 26167 were later restricted to eastern Zacatecas by Webb and Axtell (1994). Previously this taxon was recognized as *S. jarrovii minor* by Smith (1936b). This lizard seems to range in Guanajuato, Hidalgo, Jalisco, Querétaro, San Luis Potosí, Tamaulipas, Veracruz, and Zacatecas states, at high elevations of 2088 -2408 m. The saxicolous congener *S. jarrovii immucronatus* (a high and mid-elevation form) was described by (Smith, 1936a) from 10 miles north of El Pinalito, Hidalgo, México on the basis of an adult male (SVL 86 mm) with field number EHT and HMS 500 (formerly voucher FMNH 100056), which the same author assigned to the *torquatus* group (Smith, 1936b). More recently, this taxon was placed in the *minor* complex as *S. minor immucronatus* (Dixon & Lemos-Espinal, 2010; Lemos-Espinal & Smith, 2008). Apparently, this lizard occurs in Hidalgo, Querétaro, San Luis Potosí, Tamaulipas, and Veracruz, at moderate elevations of 1500 -2100 m (Chrapliwy, 1964). Supposedly it also occurs in central Veracruz, which I verify for the first time later in this paper. A related saxicolous parapatric taxon is *S. jarrovii erythrocyaneus* (a highland form), which was described by (Mertens, 1950) from an adult male specimen (holotype SVL 89 mm; Chrapliwy (1964) report maximum SVL of males 90 mm and of females 87 mm) SMF 41151 from Cadereyta, Querétaro, México, which appears to occur only in Querétaro and Hidalgo, at high elevations from 1933 -2880 m.

Three additional congeners have also been recognized from the region. The arboreal taxon *S. serrifer cariniceps* (a low and mid-elevation form) was described by (Martin, 1952) from an adult male specimen UMMZ 101537 (TL= 98 mm), taken from five miles northeast of Gómez Farías at Rancho Pano Ayuctle (sic) along the Río Sabinas, Tamaulipas. This taxon occurs in Tamaulipas, Veracruz, and Hidalgo (later state first time reported here), so that it was reported as *S. serrifer* by (Ramírez-Bautista *et al.*, 2010), at low to moderate elevation asl-1072 m. The saxicolous taxon *S. torquatus cyanogenys* (a low to mid-elevation form) was described by (Cope, 1885) from an adult male specimen cotype USNM 31377 (SVL = unknown) from Monterrey, México. Axtell & Axtell (1971) later reported maximum size in males and females of 141 mm and 130 mm, respectively. This taxon is reported to occur in Nuevo León, San Luis Potosí, and Tamaulipas, at low to moderate elevations 330 - 800 m. Finally, the saxicolous congener *S. serrifer plioporus* (a low to mid-elevation form) was described by (Smith, 1939) from 4 mi East of Encero (sic), Veracruz, México on the basis of adult male specimen FMNH 32004 (SVL 102.94 mm, measured by A. Resetar), which was also included in the *torquatus* group. Seems, this taxon ranges in San Luis Potosí, Tamaulipas, and Veracruz at low and moderate elevations of 330 -933 m.

The two former subspecies (*S. j. erythrocyaneus* and *S. j. immucronatus*) were discussed by (Wiens *et al.*, 1999), who suggest placing them within the species *S. minor*. Subsequently, Martínez-Méndez & Méndez de la Cruz (2007), based on a partial analysis of the *torquatus* group suggested several synonymies, including the three species mentioned above. In a recent nomenclatural arrangement Uetz (2020) recognize two subspecies for *cyanogenys* complex, two for the *jarrovii* complex, four for the *minor* complex and two for *serrifer* complex.

METHODS

Herein I attempt to resolve this controversy by diagnostic characters (pholidosis), geographic distribution of the species tried here, and reviewing images (including both type material and living specimens), and I follow the Hillis' methodology for delimiting sexual species (Hillis, 2019).

RESULTS AND DISCUSSION

I report several state records: the species *S. cariniceps* resurrected from the synonymy of *S. cyanogenys* or *S. serrifer* (just as previously authors) for Hidalgo; the first voucher of *S. immucronatus* from Veracruz, and by first time I confirm the presence of two more species: *S. cariniceps* and *S. cyanogenys* in such state. I also newly propose the recognition of four species (three as full species), of which three are sympatric: *S. cariniceps*, *S. cyanogenys*, *S. plioporus* (later species fide Martin (1950) cited by (Chrapliwy, 1964) for Tamaulipas, and here I add Veracruz populations), and *S. immucronatus* in allopatry from Veracruz. Likewise, given environmental continuity among the states of Veracruz, Puebla, Hidalgo, San Luis Potosí, Guanajuato and Querétaro possibly three species (*S. cariniceps*, *S. cyanogenys* and *S. plioporus*) they are possibility distributed in the southwestern Huasteca region of Querétaro, Puebla, and may be Guanajuato, in the east versants of the Sierra Madre Oriental, which have an altitudinal range less than 1500 m,

approximately. These elevations are occupied by such species in other versant regions of the Gulf in the nearest states, as much to S as to N.

The geographic distribution of each species is problematic, and there is currently a lack of taxonomic consensus. Potential misidentification of populations, mixed population data, and unclear species distributions fundamentally cloud the biogeography and taxonomy of these lizards, as suggesting for another species (Clause *et al.*, 2016).



Figure 1. *Sceloporus immucronatus* Smith, 1936 (Hidalgan Spiny Lizard) EBUAP 2808, male adult. México, límite estatal Veracruz-Hidalgo, entre municipios de Huayacocotla-San Agustín Metzquititlán, aproximadamente 5 km SE Yerbabuena, Hgo.; matorral xerófilo. 20°31'9.18" N, 98°32'57.02" W, 1960 m; sobre roca, 10 de octubre 2015, 10:23 AM. Locality E, see Fig. 12.



Figure 2. *Sceloporus jarrovii immucronatus* formerly *Sceloporus immucronatus* Smith, 1936, in this study (Hidalgan Spiny Lizard) FMNH 100056 holotype, male adult. Locality B see Fig. 12. Courtesy of Alan Resetar.

Without a comprehensive phylogeny (*sensu stricto*) of the *torquatus* group, although there is progress in the phylogeny analysis of the lizards of the genus *Sceloporus* (Sites, Wiens, Leaché, among others), besides of an incomplete known on its geographic distribution of the some one species, yet it is need a consensus about of its species groups and range. For example, regularly with a subspecific level assigned to *Sceloporus immucronatus* (as *S. jarrovii immucronatus* Smith, 1936a, see above) is knowledge that the general distribution of the species *S. jarrovii* Cope, 1875 (fide Reptil Data Base, 2018) occurring SE Arizona and SW Nuevo Mexico in

USA, to highlands of mountains of Sierra Madre Occidental of the northwestern part of México, principally, and its type locality southern Arizona, USA (fide Smith and Taylor, 1966) leaving *S. immucronatus* as an extralimital allopatric species. It has been reported as *S. j. immucronatus* in Hidalgo, 15.5 mi E Huichapan 20.38333, -99.53333 (INHS, 2018), they possibility used the proposal (fide Smith, 1936). Wiens *et al.*, (1999) proposed that all populations to the south are *S. minor* including to *S. jarrovi immucronatus*; however, first Lemos-Espinal & Smith (2008), and then Dixon & Lemos-Espinal (2010), proposed assigning them as subspecies of *S. minor* (*Sceloporus minor minor*, and *S. m. immucronatus*, without considering *S. m. erythrocyaneus*). The locality Huichapan is approximately 100 km (airline) NW of the new Veracruz locality recorded here (Fig. 3).



Figure 3. *S. cariniceps* Martin 1952 (Huastec Spiny Lizard) male adult from México, Veracruz, entre Poza Rica y Tuxpan, 20°57'7.35" N, 97°19'21.28" W, 7 m. Locality G, see Fig. 12. Courtesy of Severiano Cruz Suárez.

As *S. minor immucronatus* (fide Lemos-Espinal & Smith, 2008; Dixon & Lemos-Espinal, 2010) the general distribution of species of *S. minor* (fide Reptil Data Base, 2018) occurring southward of the Mexican Plateau, majorly, and its type locality at Pinos, Zacatecas (fide Webb & Axtell, 1964) (Fig. 3). However, with the evidence described here and again based on allopatry, I consider it best recognized as a full species, *S. immucronatus* (see below).

Sceloporus immucronatus (Fig. 1) the seems commonly is agree that ranges: W Querétaro through Hidalgo, E San Luis Potosí, SC Veracruz (Reptile Data Base, 2018); in moderate elevation, 1648 -1969 m; however, for later state, see record in this study.

In Veracruz, Pelcastre-Villafuerte & Flores-Villela (1992) reporting only five forms of *torquatus* group (*S. jarrovi immucronatus*, *S. serrifer*, *S. mucronatus*, *S. torquatus*, and *S. aureolus*); previously, all were reassigned to other groups.

Here I propose the recognition of *S. immucronatus*, as a full species, and the extension of its ranges to Veracruz State. The voucher of *S. immucronatus*.

supporting this state record is an adult male deposited in the Benemérita Universidad Autónoma de Puebla EBUAP 2808, with the following data: Límites estatales de los estados de Veracruz e Hidalgo, entre los municipios de Huayacocotla-San Agustín Metzquitlán, respectivamente; aproximadamente 5 km SE Yerbabuena, Hidalgo, 20°31'9.18" N, (20.516478), 98°32'57.02" W, (-98.552629), 1960 m; matorral xerófilo, sobre roca, 10 octubre 2015, 10:23 AM. This population occurs in a xerophytic region, with dry climatic conditions in the Huayacocotla Municipality, Veracruz (Sosa & Lorea, 2004). The surrounding habitat where the species was voucher in the Huasteca Alta of Veracruz when was the found the population of such lizard (*S. immucronatus*) corresponds to xerophytic scrub (Matorral Xerófilo), with notable plant species as follows: *Nolina perviflora*, *Sophora secundiflora*, *Juniperus deppeana*, *Pinus cembroides*, *Dasyllirion acrotriche*, *Quercus greggii*, *Bouvardia ternifolia*, *Brickellia veronicaefolia*, *Mimosa biuncifera*, *Eupatorium calophyllum*, *Cercocarpus fothergilloides*, *Gymnosperma glutinosum* (CONABIO, 2013); *Agave obscura*, *Hechtia roseana*, *Sedum lucidum*, *H. myriantha* y *H. stenopetala* (Benitez-Badillo & Welsh-Rodríguez, 2010; Gómez-Pompa *et al.*, 2010), Agriculture areas and secondary vegetation are also present on the landscape.



Figure 4. *Sceloporus serrifer cariniceps* Martin 1952 formerly *S. cariniceps* Martin 1952 (Huastec Spiny Lizard) UMMZ 101537 holotype, male adult, Locality F see Fig. 12. URL: <http://quod.lib.umich.edu/a/amphlic/x-101537/> Accessed March 29, 2020.

The specimen (EBUAP 2808) agrees with the general description of the species *S. immucronatus* (fide Smith, 1936a; Smith, 1936b; Chrapliwy, 1964; Olson, 1987) (Fig. 1 and see Key section).

The nearest locality to this new Veracruz species is *S. minor* in Hidalgo from 10 km NE El Enzuelado (20.588056 N, -98.619722 W, 1960 m asl) reported by (Ramírez-Bautista *et al.*, 2010). However, it appears that the photos shown in their publication correspond to the species *Sceloporus immucronatus* and not to *S. minor*.

Nevertheless, to I make congeners comparative there is exception, due to that I found differ of members of such *S. serrifer* complex (fide Wiens *et al.*, 1999; Martinez-Méndez & Méndez de la Cruz, 2007) as another groups that was assigned it, too.



Figure 4. *Sceloporus serrifer cariniceps* Martin 1952 formerly *S. cariniceps* Martin 1952 (Huastec Spiny Lizard) UMMZ 101537 holotype, male adult, Locality F see Fig. 12. URL: <http://quod.lib.umich.edu/a/amphlic/x-101537/> Accessed March 29, 2020.

There are two geographic races of *S. serrifer* (*S. s. plioporus*, *S. s. cariniceps* as intergrade populations) for Veracruz (fide Stuart, 1970), and both possess large supraoculars, in a row; meanwhile the lizard *S. s. serrifer* ranges in the Yucatan Peninsula, and possess undivided suproculars. The former two occur in the versant and lowland of the Mexican Gulf Coastal Plain, but both are considered synonymous with *S. serrifer* by several authors (Martinez-Méndez & Méndez de la Cruz, 2007; among others) here disagreement.

Additional localities of its congener *S. s. cariniceps* are reports from Acayuca, Molango, in Hidalgo as *S. serrifer* inhabiting cloud forest to 1072 m (fide Ramírez-Bautista *et al.*, 2010); 26 km north Limón, and Chocoy, both in Tamaulipas; Ebano, San Luis Potosí, and northern Veracruz. Stuart (1970) following to Martin (1952), did not give precise localities; nonetheless, in Veracruz the later author suggested errors in the collecting localities for this form. This lizard differs from its congeners by a combination of diagnostic characters including: a) keeled or ridged head scales between rostral and frontal scales; b) few femoral pores (Martin, 1952). In this respect, Olson (1987) suggested their synonymy, because he considering that they lack diagnostic differentiation, such is error. Species can differ from one another by a combination of multiple variables (Leaché & Sites, 2009; Hillis, 2019). Subsequently, Martinez-Méndez & Méndez de la Cruz (2007) recognized only two species (*S. prezygus* and *S. serrifer*), both allopatric with respect to related forms, which here I suggest elevating as full species to *S. plioporus* and *S. cariniceps*. In a

phylogeographic study of clade *Agkistrodon* (Parkinson *et al.*, 2000), they described similar allopatric pattern observed here for such species of lowland lizards. Nevertheless, there are problematic interbreeding zones, which warrant further study as reiterated by many previous authors.



Figure 5. *S. cariniceps* Martin, 1952 (Huastec Spiny Lizard), male and female adults, respectively, from México, Veracruz, entre Poza Rica y Tuxpan, 20°31'49.02'' N, 97°24'48.16'' W, 100 m. Locality G, see Fig. 12. Courtesy of Severiano Cruz Suárez.

Independent of their taxonomic status (species group, species complex, subspecies, among others) for these *Sceloporus* populations of eastern and northeastern of México, the combination of a set of diagnostic characters (see Key section), and geographic scenario (Fig. 12), lead me to consider each as species-level taxonomic entities (de Queiroz, 2007; Hillis, 2019). I here suggest new taxonomic combinations:

Historically	New combination
<i>S. jarrovii immucronatus</i> or	
<i>S. minor immucronatus</i>	<i>S. immucronatus</i> Smith, 1936 (this study)
<i>S. jarrovii erythrocyaneus</i> or	
<i>S. minor erythrocyaneus</i>	<i>S. erythrocyaneus</i> Mertens, 1950 (this study)
<i>S. torquatus minor</i> or	
<i>S. jarrovii minor</i>	<i>S. minor</i> Cope, 1885 (Wiens <i>et al.</i> , 1999 in part; this study)
<i>S. torquatus cyanogenys</i>	<i>S. cyanogenys</i> Cope, 1885 (Smith, 1936)
<i>S. cyanogenys plioporus</i>	<i>S. plioporus</i> Smith, 1939 (this study)
<i>S. serrifer serrifer</i>	<i>S. serrifer</i> Cope, 1866 (as suggesting Martínez-Méndez & Méndez de la Cruz, 2007)
<i>S. serrifer prezygus</i> <i>S. prezygus</i>	Smith, 1942 (as suggesting Martínez-Méndez & Méndez de la Cruz, 2007)
<i>S. serrifer plioporus</i>	<i>S. plioporus</i> Smith, 1939 (this study)
<i>S. serrifer cariniceps</i>	<i>S. cariniceps</i> Martin, 1952 (this study)



Figure 6. *Sceloporus serrifer plioporus* (formerly *Sceloporus plioporus* Smith, 1939, in this study) West (sic) Golf Spiny Lizard, better proposed here Veracruz Spiny Lizard FMNH 32004 holotype, male adult, 102.94 mm (measure by Alan Resetar). Locality D, see Fig. 12. Courtesy of Alan Resetar.

One possible alternative is to use of the new phylogenetic techniques that are useful for identifying cryptic species and solving the subspecies conflicts. For example, it is necessary a RADseq phylogeographic analysis would likely prove especially useful for testing the taxonomic arrangement I propose here.



Figure 7. *S. cyanogenys* Cope, 1885 (Blue-chinned Spiny Lizard) MCZR-21093, female adult. Locality C, see Fig. 12. Courtesy of Joseph Martinez, MCZ. ©President and Fellows of Harvard College.

Morphological Comparative (see Key section)

For all *Sceloporus* of the *torquatus* group that supposedly occur in the state of Veracruz, I examined the pholidosis and photographs of type material and living specimens, and I include a key to the species covered herein.

Sceloporus immucronatus vs. *Sceloporus minor* (USNM 26167 image Esther M. Logan, Division of Amphibians & Reptiles, USNM, Smithsonian Institution). Both differ in the type of collar. The former presents a narrow black nuchal collar, frequently 3 scales wide, while the latter has black collar that is >4 scales wide. Both shares divided supraoculars, however, in *S. immucronatus* they are small and approximately the same size, while in *S. minor* they form two rows of large supraocular plates (fide Cope, 1885). In the former species the dorsal scales larger than the latter (fide Cope, 1885). Smith (1936a) summarized the morphological

characters of both species, which my Key expands upon. The elevation range differs between these species as well, with *S. t. minor* ranging from 2088 -2408 m (Webb & Axtell, 1994), while *S. immucronatus* ranges from 1648 -1960 m, approximately.



Figure 8. *S. minor* Cope, 1885 (Minor Spiny Lizard or Cope's Mountain Spiny Lizard), USNM 26167 lectotype (fide Webb & Axtell, 1994) male adult. Locality A, see Fig. 12. Courtesy of Esther M. Langan (Smithsonian Institution).

Sceloporus immucronatus vs. *Sceloporus cyanogenys*.

The historical records of *S. immucronatus* in the state of Veracruz correspond to another species. Photographic study of specimen MCZ R-21093 suggests that it corresponds formerly to *S. cyanogenys*, although direct examination of this specimen remains necessary. The former species possess dorsal scales over 40 vs later species under 40, respectively. Likewise, both differ in the width of the black nuchal collar: 2-3 scales in *S. immucronatus* vs 4 or more in *S. cyanogenys*, (see Figs. 1, 2 and 7, respectively) and Key section by more differs.

Moreover, both *S. immucronatus*, and *S. cyanogenys* are allopatric, such as another species of the genus *Sceloporus* sharing supraoculars divided on the head, a character highlights in this specimen (MCZ R-21093, Fig. 7), posses two rows of supraoculars, differ in the dorsal scales due are larger in the later than in the former, the others characters fall on the variation (see Olson, 1987), and for size and meristic features (revised Smith, 1936b).

Moreover in agreement type localities of *S. jarrovii* and *S. minor* both are allopatric species of *S. immucronatus*; the former ranges in the summit of Sierra Madre Occidental, meanwhile the second ranges in the slopes and summit of the mountains of the same Sierra Madre in Zacatecas and Jalisco states, recently as new record by later (Webb & Axtell, 1994; Arenas-Monroy *et al.*, 2012, respectively). Likewise, the three species are allopatric with respect to all species of the *serrifer* complex.

Due to misidentification, it was previously assumed that the record in Presidio, north of Montzorongo (sic), Municipality of Tezonapa, Veracruz (MCZ R-21093)

corresponded *S. jarrovi immucronatus*=*S. minor* of the *torquatus* group (fide Wiens *et al.*, 1999). The specimen is adult female, formerly belongs to the *torquatus* group may be relative to *S. cyanogenys* (by implicate taxonomic sense, here study). However, there is still no consensus regarding the taxonomy of the *serrifer* complex, and authors appear to agree that additional study is needed, see proposal by Stuart (1970); but again studies of *S. cyanogenys* are also needed from Veracruz.



Figure 9. *Sceloporus jarrovi erythrocyaneus* Mertens, 1950 here tried as *S. erythrocyaneus* Mertens, 1950 Red Spotted Minor Spiny Lizard, SMF 41151 holotype male adult. Locality H, see Fig. 12. Courtesy of Jakob Hallermann, ZUH.



Figure 10. *Sceloporus erythrocyaneus* Mertens, 1950 Red Spotted Minor Spiny Lizard, male adult, México, Querétaro, Reserva de la Biosfera Sierra Gorda, September 2019.

The locality Presidio=Plan de Libres lies in the lowlands of the Mexico Gulf versant, and is 320 m elevation (GoogleMaps), a locality lower than *S. immucronatus* which is regularly found above 1500 m elevation. Likewise, *S. immucronatus* ranges on the western slopes of the Sierra Madre Oriental and the extreme southeastern Mexican

Plateau. On the other hand, *S. minor* ranges on the western slopes of Sierra Madre Occidental and extreme southwestern Mexican Plateau. Additionally, *S. pliopus* and *S. cyanogenys* range on the eastern slope of same Sierra on versant and plain of Mexican Gulf (see Fig. 12).

Another records in Veracruz state for *S. j. minor* (which might actually represent *S. cyanogenys* or *S. pliopus*) are: Venta de Enero= La Venta de Encerro, La Encerro, Encero o El Encerro, cerca de Dos Ríos (10 mi SE Jalapa) (Pelcastre-Villafuerte & Flores-Villela, 1992). Encero (sic): 8 miles east -southeast of Jalapa (Smith & Taylor, 1966). As *S. serrifer pliopus* are: Venta del Enero, Boca del Río, and 1 mi E Papantla (Olson, 1987). Therefore, possibility the correct name of locality is: El Lencero = 8 mi E-SE Jalapa, Mpio. Emiliano Zapata, Veracruz.



Figure 11. *Sceloporus erythrocyaneus* Mertens, 1950 Red Spotted Minor Spiny Lizard, female adult, México, Querétaro, Reserva de la Biosfera Sierra Gorda, September 2019.

Comparative studies of *Sceloporus immucronatus*

Several authors have used *S. immucronatus* as comparative material: Axtell & Axtell (1971) make a comparative between the known populations of the *jarrovi* complex, including *S. immucronatus* from Hidalgo, San Luis Potosi and Tamaulipas. The same as subspecies Lemos-Espinal & Smith (2008) they use it; both Dixon & Lemos-Espinal, (2010) and Smith (1936) recognized *S. m. immucronatus*. While others recognize it as the subspecies *S. j. immucronatus* or *S. m. immucronatus*, seemingly without having revised the specimens that supports to the registration of this subspecies and perpetuating misinterpretations by previous authors (see above). Additionally, Morales-Mávila *et al.*, (2011) don't recognize (in this case, while in other reptiles they make this way it) to the subspecies of *S. serrifer*, making a mistake in the assignment of the species, since this species is distributed in the Peninsula of Yucatan; while it is possibly in fact was *S. pliopus*, how here I propose (although consensus doesn't still exist in the recognition of this last species) they register to both congeners in the same areas of central and southern Veracruz.

Recently, a biogeographical study of the amphibians and reptiles of Hidalgo suggesting that the species *S. minor* (sensu lato) (fide Wiens *et al.*, 1999) is found in arid zones (see Fernández-Badillo *et al.*, 2016), such as the population founded here, to seems all record belongs to the species *S. immucronatus*, therefore it is need more field work, and phylogenomic studies of such species.

Herpetological studies in the Huayacocotla region

Only one study of the reptiles and amphibians exists for the Huayacocotla region, however *S. immucronatus* was not registered, and only four congeners were reported (Camarillo-Rangel & Casas-Andreu, 1998); As such, the *Sceloporus immucronatus* record reported here represents a discovery of biogeographical interest to for help establish a proposed Ecological Reserve in the Huayacocotla Municipality and adjacent areas, to preserve the flora and fauna of this region (CONABIO, 1996).

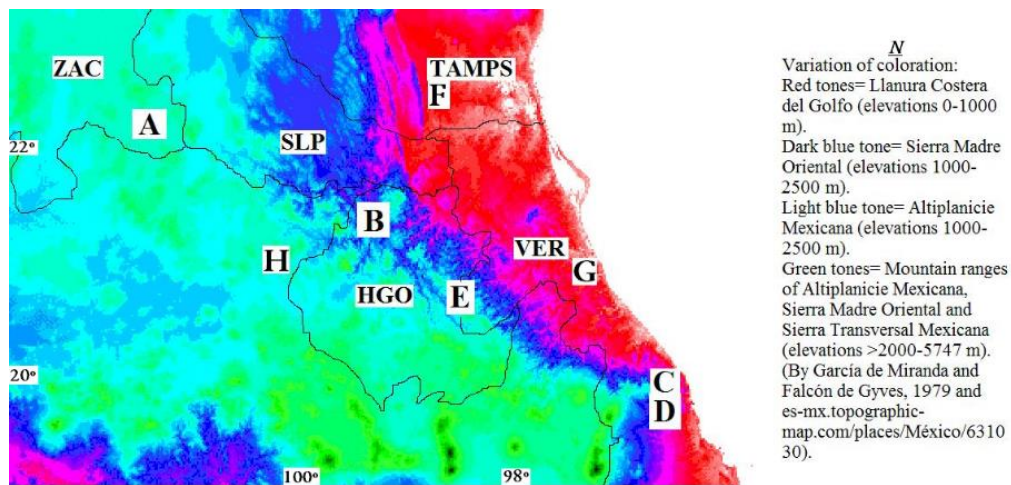


Figure 12. Eastern, and northeastern-Central of México. Type localities: A. *Sceloporus torquatus minor* (fide Webb & Axtell, 1994 here tried as *S. minor* Cope, 1885) (see text, Fig. 8); B. *S. jarrovi immucronatus* (fide Smith, 1936a here tried as *S. immucronatus* Smith, 1936a) (see text, Fig. 1, 2); D. *S. serrifer pliopus* (fide Smith, 1939 here tried as *S. pliopus* Smith, 1939) (see text, Fig. 6). Another localities: C. MCZ R-21093 *S. cyanogenys* (see text, Fig. 7); E. EBUAP 2808 *S. immucronatus* (see text, Fig. 1); F. *S. s. cariniceps* (fide Martin, 1952 formerly *S. cariniceps* Martin, 1952 here study (see text, Fig. 4); G. *S. cariniceps* (see text, Figs. 3, 5); H. *S. j. erythrocyaneus* Mertens, 1950 here tried as *S. erythrocyaneus* Mertens, 1950 (see text, Fig. 9, 10, 11). Scale map _____=100 km. (Abbreviations: *N* =north, HGO =Hidalgo, SLP =San Luis Potosí, TAMPS =Tamaulipas, VER =Veracruz, ZAC =Zacatecas).

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Key artificial to the *torquatus* group species of genus *Sceloporus* ranging in Mexican Plateau and lowland of Veracruz and adjacent states (except *S. minor* ranges Jalisco, San Luis Potosí and Zacatecas states, and *S. erythrocyaneus* ranges Querétaro, and Hidalgo. Likewise, how commonly known another three species of the same group range in the same state: *S. aureolus*, *S. mucronatus*, and *S. torquatus*, which are easy differentiated: two former posses supraoculars divided vs later supraocular large and in a row; moreover they differ in coloration: the former present in each dorsals scales a light point vs. two later dark ground scales respectively, and differ in pattern of anterior light border, in *S. aureolus* and *S. mucronatus* is right, in *S. torquatus* is forward curved. The three species occurring in highland and summit of the Sierra Madre Oriental, Sierra Transversal Mexicana and Nudo Mixteco- between Veracruz and Oaxaca, respectively); some characters used locally. (Note: Key using original descriptions or relevant studies (Cope, 1885; Smith, 1936a, 1939; Mertens, 1950; Martin, 1952; Chrapliwy, 1964; Smith & Álvarez, 1974; Olson, 1987, respectively).

1. Scales on the head hard keeled (carinated), raising principally postrostrals and internasals, which are longitudinally enlarged, another light or moderated carinated, usually; two central postrostrals enlarge, raising and carinated, another two postrostrals rounded in the same size; supraoculars large in a row (2-5 same size, 3-4 same size, approximately); black nuchal collar wide, 4 o more scales dorsally; dorsal scales 28-34, average 31.85; femoral pores 16-22, average 19.68..... *S. cariniceps*

1. Scales on the head smooth, flat mainly, which are as wide as long, vary small to large size; four postrostrals rounded, and same size, approximately; supraoculars divided or undivided: black nuchal collar wide or narrow.....2

2. Black nuchal collar wide, 5-7 scales, and whole black collar surface of the similar size, usually; dorsal scales 38-47, average 41.6; femoral pores 22-28, average 24.7; supraoculars divided, in two complete rows.....*S. minor* (Fig. 8)

2. Black nuchal collar narrow or appear wide, 4 or less scales.....3

3. Supraoculars large, usually; dorsal scales 30-35, average 31.7; on each thigh femoral pores 9-14, average 11.9 (on both thighs 20 -27, average 23.8).....*S. pliopus* (Fig. 6)

3. Supraoculars variable; however in two rows similar size or usually inner row larger than outer row.....4

4. Dorsal scales 32-40, average 37; femoral pores 10-14, average 13.3; supraoculars divided; black nuchal collar wide 4 scales.....*S. cyanogenys* (Fig. 7)
4. Dorsal scales more 40.....5
5. Dorsal scales 36-48, average 42; femoral pores 12-19 each side, total 24-36, average 30.8; supraoculars divided regularly, the inner complete, the outer incomplete; black nuchal collar, narrow 2 or 3 scales wide.....*S. immucronatus* (Fig. 1, 2)
5. Dorsal scales 43-50, average 46.1; femoral pores total 23-32 (28.7); supraoculars divided; black nuchal collar, wide 4 or more scales.

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