A NEW MONTANE RATTLESNAKE (VIPERIDAE) FROM MICHOACAN, MEXICO

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ABSTRACT: A new species of rattlesnake is described from the upper elevations of Cerro Tancitáro in Michoacán, in the western portion of the Transverse Volcanic Cordillera. This diminutive rattlesnake appears to be most closely related to several species also occurring at high elevations in Mexico and the southwestern United States including Crotalus intermedius, C. pricei, and C. transversus. The Tancitáro species is most similar to C. transversus, but differs in aspects of lepidosis and color pattern.

Key words: Cerro Tancitáro; Crotalus tancitarensis; Mexico; Michoacán; New species; Reptilia; Serpentes; Squamata; Viperidae

THE MEXICAN Plateau and associated highlands have long been recognized for their richness of rattlesnake species, and this region has been suggested as the “center of origin” for this group of snakes (Gloyd, 1940). This region harbors the greatest number of species of small montane rattlesnakes, which have presented challenges to several generations of taxonomists.

Confusion regarding these montane rattlesnakes was augmented by various authors, but most notably Amaral (1927) and Bouleneger (1896), who had difficulty distinguishing them and synonymized such distinct species as Crotalus triseriatus, C. intermedius, and C. pricei into a single species. All individuals in a series of rattlesnakes from Cerro Tancitáro, consisting of three species (C. triseriatus, C. pusillus, and the species described herein), were allocated to C. triseriatus by Schmidt and Shannon (1947). Klauber (1952) recognized the composite nature of this series—he distinguished and described C. pusillus, recognized C. triseriatus as comprising part of the series, and identified one individual as C. intermedius. Subsequently, this single specimen from Cerro Tancitáro was referred to as C. intermedius by a number of authors (Armstrong and Murphy, 1979; Duellman, 1961; Harris and Simmons, 1978; Klauber, 1972). Campbell (1982) questioned the allocation of the Tancitáro specimen to C. intermedius and suggested it was more closely allied to C. transversus or perhaps represented a novel species.

MATERIALS AND METHODS

Scale definitions and protocols for making scale counts follow Klauber (1972) and Campbell and Lamar (2004). Measurements of body and tail were taken to the nearest 1 mm using a meter stick; those of the head, fang, and rattle were made to the nearest 0.1 mm using vernier calipers. Geographic coordinates were obtained using a handheld GPS receiver; geographic names and distances are based on topographic maps (1: 1,000,000) issued by the Dirección General de Geografía, Mexico. Specimens were fixed in buffered formalin (diluted to 10% of stock solution) and then transferred within 1 wk into 70% ethanol for permanent storage. Notes of color in life were taken from photographs of live specimens and notes taken from observation.

This new little rattlesnake, insofar as is known, is restricted to the upper elevations of the impressive volcano known as Cerro Tancitáro. It may be known as:

Crotalus tancitarensis sp. nov.

Crotalus triseriatus triseriatus—Schmidt and Shannon, 1947, Fieldiana Zoology 31(9): 84 [Not of Wagler, 1830]
Crotalus intermedius intermedius—Klauber, 1952, Bulletin of the Zoological Society of San Diego 26: 9 [Not of Troschel in Müller, 1865]
Crotalus species inquirenda, Campbell, 1982, Southwestern Naturalist 27(3): 353

Holotype.—Herpetología, Instituto de Investigaciones sobre los Recursos Naturales, Universidad Michoacana de San Nicolás de Hidalgo, Michoacán (INIRENA 309), an adult female from Cerro Tancítaro, Michoacán, Mexico, 3225 m elevation (coordinates 19° 24’ 13” N, 102° 19’ 45” W), collected on 17 July 2002 by Javier Alvarado-Díaz and Alfredo Estrada Virgen (Fig. 1A).

Paratypes.—The University of Texas at Arlington (UTA) R-52401 [formerly INIRENA 308], an adult female collected at same locality on the same date by the same collectors as the holotype (Fig. 1B); Field Museum of Natural History (FMNH) 39115, an adult female from Cerro Tancítaro, reportedly from 1524 m, collected between 25 June and 20 July 1941, by F. A. Shannon.

Diagnosis.—Crotalus tancitarensis may be distinguished from all other species of rattle-snakes by the combination of 21 dorsal scale rows at midbody, a dorsal pattern of 49–51 narrow crossbands, and a loreal that is longer than high and in contact with the supralabial series (Fig. 2). Crotalus tancitarensis is a diminutive montane rattlesnake in the C. intermedius group, which includes C. intermedius, C. pricei, and C. transversus (Table 1). Species in this group are defined by having a small, narrow head and 21 dorsal scale rows at midbody. Crotalus intermedius differs from C. tancitarensis in usually having paired nape markings, middorsal blotches rather than crossbands, usually four scales across the prefrontal region, and a loreal that is as high or higher than long. Crotalus pricei may be distinguished by the shape (or absence) of the nape blotches, paravertebral blotches that are separated or narrowly fused across the dorsum, usually four scales across the prefrontal region, and a loreal that is usually in contact with the lower preocular but does not contact the supralabial series. Crotalus transversus differs from C. tancitarensis in having paired parentheses-shaped or parallel blotches or bars on the nape, 37–43 (versus 49–51) dorsal crossbands on the body, a loreal that is as high or higher than long and that usually does not contact the supralabial series, a lower preocular that is narrowly tapered anteriorly but usually reaches the loreal, and 136–155 ventrals in females (versus 158–160).

Individuals of several other species of montane rattlesnakes in Mexico may have 21 dorsal scale rows at midbody, although this is not the modal number for most populations. Crotalus aquilus, C. lepidus, C. ravus, and C. triseriatus all have fewer than 45 primary dorsal markings on the body and usually more than 10 supralabials. Crotalus aquilus, C. ravus, and C. triseriatus are further distinguished from C. tancitarensis by having 156 or fewer ventrals and body markings in the form of distinct middorsal blotches. The dorsal body pattern of C. lepidus is usually of dark crossbands, but these are more than a single dorsal scale long. Further the upper preocular in C. lepidus is vertically divided.

Description of holotype.—The rostral is about 1.5 times wider than high. There are two large, platelike internasals that are in contact with the rostral; three prefrontals are present (lateral scales may be considered canthals), with two large scales laterally and a smaller scale medially, and two intersupraloculars. A single loreal is present on each side and intervenes to preclude postnasal–upper preocular contact. The loreal is broadly separated from the lower preocular, but does contact the first and second supralabials. A prelacunal is inserted partially between the loreal and second supralabial, preventing broad contact of these scales. No prefoveals are present. The prenasal and postnasal are in contact with the first supralabial. The upper preocular is not vertically divided. The anterior subocular contacts supralabials 3–4. No interoculabials are present, and the subocular scales are in contact with the supralabial series. There are 9/9 supralabials, 9/9 infralabials, 21 dorsal scale rows at midbody, 158 ventrals (exclusive of preventrals), 21 subcaudals (proximal 11 undivided, distal 10 divided), and 8 rattle-fringe scales.

Measurements of holotype.—The holotype (INIRENA 309) is an adult female, 35.6 cm in total length (TL), with a tail length of 2.9 cm (8.1% of total). The head length is 17.5 mm and the width of the proximal segment (sensu Klauber, 1972) is 3.5 mm. There are 11 rattle segments that appear to represent the complete rattle.
Coloration of holotype.—The dorsal ground color in life was pale blue-gray. A black omega-shaped nape mark is present and a black postocular stripe extends from the lower posterior edge of the eye to the angle of the jaw. The supralabials were cream with black mottling. The body has 51 dark crossbands, which are one scale long with irregular edges and not bordered by any color other than the background color. At midbody, crossbands extend to about the third scale row. There are 11 crossbands on the tail; the tail bands on the distal portion of the tail are not complete and are broken along the vertebral line. An irregular stripe, pinkish copper in life and 1 to 3 scales wide on the anterior of the body, extends along the middorsum and is interrupted by the crossbands. The mental is black and the infralabials are cream with black mottling. The throat is also cream. The anterior half of each ventral scale is cream with a dark gray suffusion; posteriorly each ventral was copper-colored. The proximal subcaudals are colored similarly to the ventrals, but became orangish on the distal third of the tail. The basal segment of the rattle was orange.

Variation.—The paratypes (when two figures are given, UTA R-52401 followed by FMNH 39115) are females 39.7 and 41.0 cm in TL, with tail lengths of 3.0 and 2.6 cm (7.6 and 6.3% of total). The head length is 18.2 and 19.2 mm and the fang measures 2.0 and 1.7 mm from the upper lumen to the tip. The proximal rattle segment is 3.7 and 4.0 mm wide. There are two rattle segments in UTA R-52401. The anal glands extend posteriorly for about six subcaudals.

Three or four internasals are present (UTA and FMNH, respectively), and the scales on top of the head are smooth with weak keeling beginning posterior to the parietal region. A small prefoveal is present on the right side in FMNH 39115. The loreal contacts supralabials 1–2 on both sides in UTA R-52401, and, in FMNH 39115, it contacts supralabials 1–2 on the left side and only supralabial 1 on the right side. On the anterior portion of the body, the lower three scale rows are smooth; at
midbody only the lower two scale rows are smooth, and this number is reduced to a single row posteriorly. There are 9 supralabials (8 on one side of FMNH 39115), 9 infralabials (10 on one side in FMNH), 21 midbody dorsal scale rows, 159–160 ventrals, and 21–22 subcaudals (distal 5 divided in UTA R-52401).

The type-locality of *C. tancitarensis* is dominated by a pine–fir forest. Other trees in the area include willows and a narrow-leaved species of oak (Goldman, 1951). The holotype and one of the paratypes were found on an exposed, southeast-facing talus slope that was covered with a patch (60 × 25 m) of bunchgrass intermingled with rocks and boulders. The snakes were collected at approximately the same elevation (3225 m) only about 50 m and 15 min apart. The paratype was found under a rock at 1400 h, and the holotype was encountered lying exposed on the ground at 1415 h. Rain had fallen a short time previously, and cloudy conditions prevailed with dappled sunlight filtering through the clouds. The air temperature was 14 C.

Table 1.—Selected characteristics of lepidosis and pattern for members of the *Crotalus intermedius* group. Where two ranges of figures are given, males are above females.

<table>
<thead>
<tr>
<th>Characters</th>
<th><em>C. intermedius</em></th>
<th><em>C. pricei</em></th>
<th><em>C. tancitarensis</em></th>
<th><em>C. transversus</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nape marking</td>
<td>Paired parentheses-shaped or parallel bars, rarely fused anteriorly</td>
<td>Variable; usually paired bars that may be fused posteriorly; nape markings often absent</td>
<td>Inverted omega or incomplete circle</td>
<td>Paired parentheses shaped or parallel blotches or bars</td>
</tr>
<tr>
<td>Dorsal body pattern (exclusive of tail)</td>
<td>38–61 small dorsal blotches</td>
<td>Most frequently 39–64 small paravertebral blotches; sometimes fused medially</td>
<td>49–51 dorsal crossbands</td>
<td>37–43 dorsal crossbands</td>
</tr>
<tr>
<td>Scales across prefrontal region</td>
<td>Usually 4</td>
<td>Usually 4</td>
<td>Usually 3</td>
<td>Usually 3</td>
</tr>
<tr>
<td>Shape of loreal</td>
<td>As high or higher than long</td>
<td>Longer than high</td>
<td>Longer than high</td>
<td>As high or higher than long</td>
</tr>
<tr>
<td>Loreal–lower preocular contact</td>
<td>Yes, or narrowly separated</td>
<td>Yes</td>
<td>No</td>
<td>Usually, lower preocular narrowly tapered anteriorly</td>
</tr>
<tr>
<td>Loreal contact with supralabial series</td>
<td>Often in contact with supralabials 1–2 but sometimes separated by prefoveal</td>
<td>No</td>
<td>Yes</td>
<td>Usually no</td>
</tr>
<tr>
<td>Ventrals</td>
<td>151–175</td>
<td>137–162</td>
<td>158–160</td>
<td>141–145</td>
</tr>
<tr>
<td>Subcaudals</td>
<td>21–29</td>
<td>21–33</td>
<td>21–22</td>
<td>25–26</td>
</tr>
<tr>
<td></td>
<td>18–24</td>
<td>18–27</td>
<td></td>
<td>19–22</td>
</tr>
</tbody>
</table>

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*Crotalus triseriatus* has been found at similar elevations to *C. tancitarensis* on Cerro Tancitároro, and apparently these two species are sympatric. Another montane species, *Crotalus pusillus*, occurs somewhat lower on the mountain at elevations of 1525–2380 m.
(Campbell and Lamar, 2004). *Crotalus pusillus* is similar in appearance to *C. triseriatus*, and a series of snakes from Cerro Tancitaro containing both of these species and one individual of *C. tancitarensis* were all reported under *C. triseriatus* (Schmidt and Shannon, 1947).

The elevation from where one of the para
types (FMNH 39115) purportedly was col
clected appears to be unusually low (1524 m)
in comparison with the provenance of other
individuals of this group, which rarely descend
to 2000 m. We suspect that the elevational data
for this specimen pertains to the elevation for
the base camp or the primary collecting
locality of the field party.

**Etymology.**—The specific epithet is derived
from the name of the type locality, Tancitaro
and the Latin suffix -*ensis*, denoting place. The
name Tancitaro is taken from the Tarascan
language and means “place of offering.”

**Discussion.**—*Crotalus tancitarensis* shares
similarities with several other montane species
of rattlesnakes, most notably *C. intermedius*,
*C. pricei*, and *C. transversus*. It is most similar
to *C. transversus* in color pattern. *Crotalus transversus* is known from several localities in
the highlands to the south and west of Mexico
City (Fig. 3; Camarillo and Campbell, 1993,
2002; Campbell, 1988; Taylor, 1944). These
localities are separated from the type-locality
of *C. tancitarensis* by over 300 km of mostly
unfavorable habitat, although small, isolated
patches of high montane forest occur on
several of the higher volcanoes of the western
portion of the Transverse Volcanic Cordillera,
including Nevado de Toluca (4690 m, México),
Cerro de San André s (3500 m, Michoacán),
and Nevado de Colima (4240 m, Jalisco). It is
possible that yet undiscovered populations
of rattlesnakes occur on these intervening
highlands.

On the basis of morphology, size and
proportions, and elevational and geographical
distribution, Gloyd (1940) implied a close
relationship among certain montane species
when he proposed recognition of the *C.
triseriatus* group, which was composed of
two species: *C. triseriatus* containing five
subspecies (*triseriatus*, *pricei, omiltemanus*,
*anahuacus*, and *miquihuanus*) and *C. lepidus*
containing two subspecies (*lepidus* and *klaub-
beri*).
(Klauber, 1972) and molecular cladistics (Murphy et al., 2002). Klauber (1972) suggested that C. aquilus, C. pusillus, and C. triseriatus were contained within the C. intermedius group, whereas Murphy et al. (2002) excluded those species from the C. intermedius group, and indicated that C. willardi was the sister-taxon to the C. intermedius group.

Members of the C. triseriatus group (containing C. triseriatus, C. aquilus, and C. lepidus) may be distinguished from the C. intermedius group most easily by the presence of prefoveals, usually 23 or more rows of dorsal scales at midbody, a relatively larger, broader head, and a stouter body (Dorcas, 1992; Klauber, 1952; Smith, 1946).

**Resumen**

Una nueva especie de serpiente de cascabel se describe de las altas elevaciones del Cerro Tancítaro en Michoacán, en la porción Oeste de la Cordillera Volcánica Transversal. Esta cascabel diminuta aparenta estar cercanamente relacionada a varias especies que también ocurren a altas elevaciones en México y en el Sur Oeste de los Estados Unidos, *Crotalus intermedius*, *C. pricei* y *C. transversus*. La especie de Tancítaro es mas similar a *C. transversus*, pero difiere en aspectos de lepidosis y patrón de color.

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**Literature Cited**


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