

NUMBER 465
21 APRIL 1997

CONTRIBUTIONS IN SCIENCE

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NATURAL HISTORY MUSEUM
OF LOS ANGELES COUNTY
900 EXPOSITION BOULEVARD
LOS ANGELES, CALIFORNIA 90007

Printed at Allen Press, Inc., Lawrence, Kansas
ISSN 0459-8113

A NEW SPECIES OF *LEPIDOPHYMA* (SAURIA: XANTUSIIDAE) FROM OAXACA, MEXICO

ROBERT L. BEZY¹ AND JOSE L. CAMARILLO R.²

ABSTRACT. A new species of *Lepidophyma* is described from a southeastern extension of the Sierra Aloapaneca in Oaxaca, México. It is found in rock-crevices and resembles *L. gaigeae*, *L. dontomasi*, and *L. radula* in its small body size and weakly differentiated tubercular scales, but differs in aspects of caudal scalation and in number of dorsal scales.

RESUMEN. Se describe una nueva especie de *Lepidophyma* de una extensión sureste de la Sierra Aloapaneca en Oaxaca, México. Se le encuentra en grietas de rocas y se asemeja a *L. gaigeae*, *L. dontomasi*, y *L. radula* en el tamaño corporal pequeño y escamas tuberculares débilmente diferenciadas, pero difiere en aspectos de escamación caudal y en el número de escamas dorsales.

INTRODUCTION

Members of the xantusiid genus *Lepidophyma* A. Duméril 1851 generally are characterized by the presence of heterogeneous scalation with large pyramidal keeled tubercles interspersed with smaller smooth scales. Within this genus three species, *L. dontomasi* (Smith 1942), *L. gaigeae* Mosauer 1936, and *L. radula* (Smith 1942), form a distinct phenetic cluster characterized by having a smaller body size and weakly differentiated tubercular scalation (Bezy and Camarillo, 1992; Smith, 1973). One of these species, *L. radula*, was previously known from only three specimens from two localities on opposite sides of the continental divide in Oaxaca, México. Recent field work has yielded 14 additional specimens, which demonstrate that the material from one of the localities represents a previously undescribed species.

MATERIALS AND METHODS

Data for 20 scale characters from the type series of the species described herein were compared with those from 1308 specimens of *Lepidophyma* representing all nominal species and including all holotypes. Data were analyzed using the BMDP programs (Dixon, 1990) for univariate statistics (1D) and stepwise discriminant analysis (7M). In the discriminant analyses each *a priori* group consisted of a separate locality sample. Museum collection abbreviations follow Leviton et al. (1985), with the addition of ENEPI for the Escuela Nacional Estudios Profesionales, Iztacala, of the Universidad Nacional Autónoma de México. Specimens used for comparisons are listed by Bezy

and Camarillo (1992). Scale terminology generally follows that of Savage (1963). Karyotype preparation and terminology are those of Bezy (1972).

The 20 scale characters used are as follows (see Bezy, 1989, for a more complete description): FPT, total femoral pores; LTR, lateral tubercle rows (axilla to groin); DBPVR, dorsals separating paravertebral rows of tubercles; IWD2, dorsal interwhorls in second caudal segment; IWV2, ventral interwhorls in second caudal segment; PTMP, pretympans (total both sides) separating postocular from second postorbital supralabial; DBPVT, number of small dorsal scales equivalent to distance separating the large tubercles within a paravertebral row; GC1IL, gulars contacting first pair of infralabials; GUL, gulars (fold to second infralabials); PVTL, large tubercles in paravertebral row (axilla to groin); VL, ventrals (gular region to vent, including preanals); 4TL, fourth toe lamellae; 4TLD, fourth toe lamellae divided by a ventral suture; DOR, dorsals (occiput to rump); DAPVR, dorsals along row immediately above paravertebral row (axilla to groin); PVR, total scales in paravertebral row (axilla to groin); PVS, scales in paravertebral row (axilla to groin) smaller than 1.5 dorsals; PVT1, scales in paravertebral row (axilla to groin) larger than 1.5 dorsals; PVT2, scales in paravertebral row (axilla to groin) larger than 2.0 dorsals; PVT3, scales in paravertebral row (axilla to groin) larger than 3.0 dorsal scales.

SPECIES DESCRIPTION

Lepidophyma lowei sp. nov.

Lowe's Tropical Night Lizard

Lagartija Nocturna de Lowe

Figs. 1-3.

HOLOTYPE. IBH 7500 (formerly ENEPI 3728), adult male, collected 4.0 km (by rd) SE San Bartolomé Zoogocho, Municipio Zoogocho, former Distrito Villa Alta, Oaxaca, México (17° 14' N, 96° 15' W; ca. 2200 m elev.) on 28 Sept. 1991 by J.L. Camarillo R.

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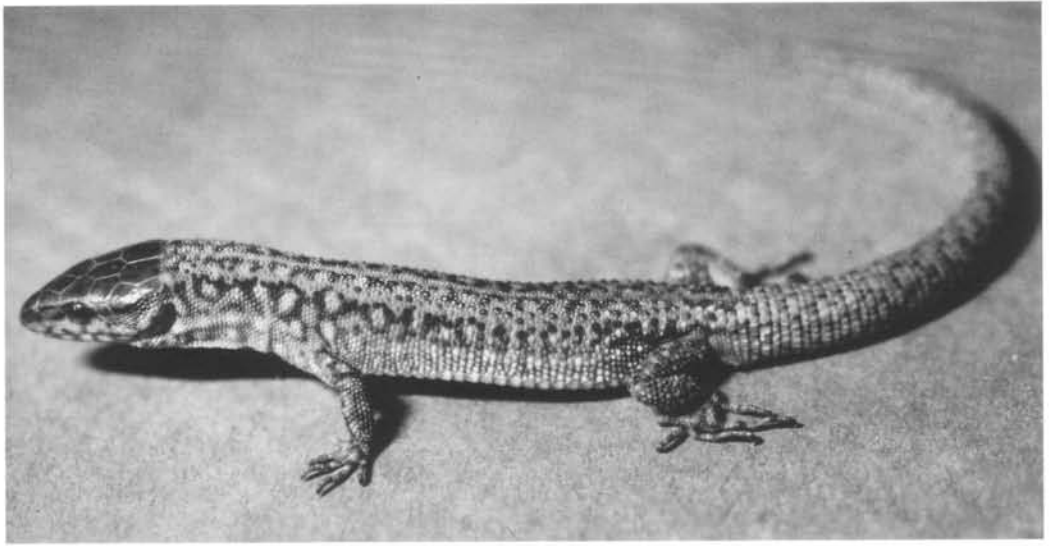


Figure 1. The holotype (IBH 7500) of *Lepidophyma lowei* in life.

PARATYPES. ENEPI 3732-33, 3804-07, IBH 7497-7499 (formerly ENEPI 3729-31), LACM 143367-68 (formerly ENEPI 3734-35): same locality as holotype; ENEPI 3738: 5.8 km (by rd) S San Bartolomé Zoogocho; ENEPI 3739: 1.0 km (by rd) SE San Bartolomé Zoogocho; ENCB 5671-72: Zoogocho.

DIAGNOSIS. *Lepidophyma lowei* resembles *L. dontomasi* and *L. radula* in that the enlarged caudal whorls are separated dorsally by two rows of smaller interwhorls, only one of which is complete across the venter (Fig. 3). In all other members of the genus the enlarged caudal whorls are separated ventrally by two or more complete rings of interwhorls. It differs from *L. dontomasi*, *L. gaigeae*, and *L. radula* in having a greater number of mid-dorsal scales between the occiput and rump (158–170 vs. 128–151). In *L. lowei* there are 28–31 vertical rows of slightly enlarged tubercles along the side of the body between the axilla and groin, whereas there are 24 in the one known specimen of *L. radula*. In *L. dontomasi* and *L. gaigeae* the side of the body lacks vertical rows of distinctly enlarged tubercles but has 39–73 subequal scales along a line from above the axilla to above the groin.

DESCRIPTION OF HOLOTYPE. Measurements (in mm): Snout–vent length, 53; tail length, 77 (complete); head length, 12.3; head width, 8.1; head depth, 5.4; orbit length, 2.3; fourth toe length, 12.1.

Scalation (Fig. 2). Nasals in contact posterior to rostral, followed by a median frontonasal, two prefrontals, a median prefrontal, and two frontals (medial suture of the frontals shorter than the median prefrontal); interparietal (with parietal organ faintly visible) touching both frontals anteriorly and

postparietals posteriorly, and separating lateral parietals; postparietals lacking anomalous sutures. Nostril bordered by nasal, postnasal, and first supralabial; postnasal followed by anterior loreal (higher than postnasal) and posterior loreal (ca. twice the size of the anterior loreal); very narrow vertically linear upper preocular, separated from labials by a triangular lower preocular; three postoculars, uppermost contacting parietal. Postoculars followed by anterior temporals (two on right side, three on left), a very large second upper temporal (subequal to parietal), and a large third upper temporal (ca. one-fourth size of postparietal); postocular separated from seventh supralabial by two large scales; pretymppanic area with six (right)/seven (left) enlarged scales arranged in vertical row, followed by 5/6 auriculars bordering tympanic opening. Eight supralabials, fifth (right)/fourth (left) below eye, seventh smaller than sixth. Large mental followed by four pairs of infralabials, fourth pair smallest (ca. one-fifth size of third pair), and first two pairs having broad common median sutures; gular scales small, 34 along midline between fold and second pair of infralabials.

Dorsal and lateral surfaces of body covered by small granules or scales of varying sizes, interspersed with numerous slightly enlarged, weakly keeled tubercles. Paravertebral rows of tubercles heterogeneous in size, composed of large weakly keeled tubercles (> three times the size of adjacent mid-dorsal scales), each followed by one or more smaller scales of varying sizes; 21 large tubercles in each paravertebral row between axilla and groin. Vertebral area with smaller granules, three between paravertebral rows, 158 along vertebral line between occiput and rump. Large tubercles on sides of body arranged in poorly defined vertical rows

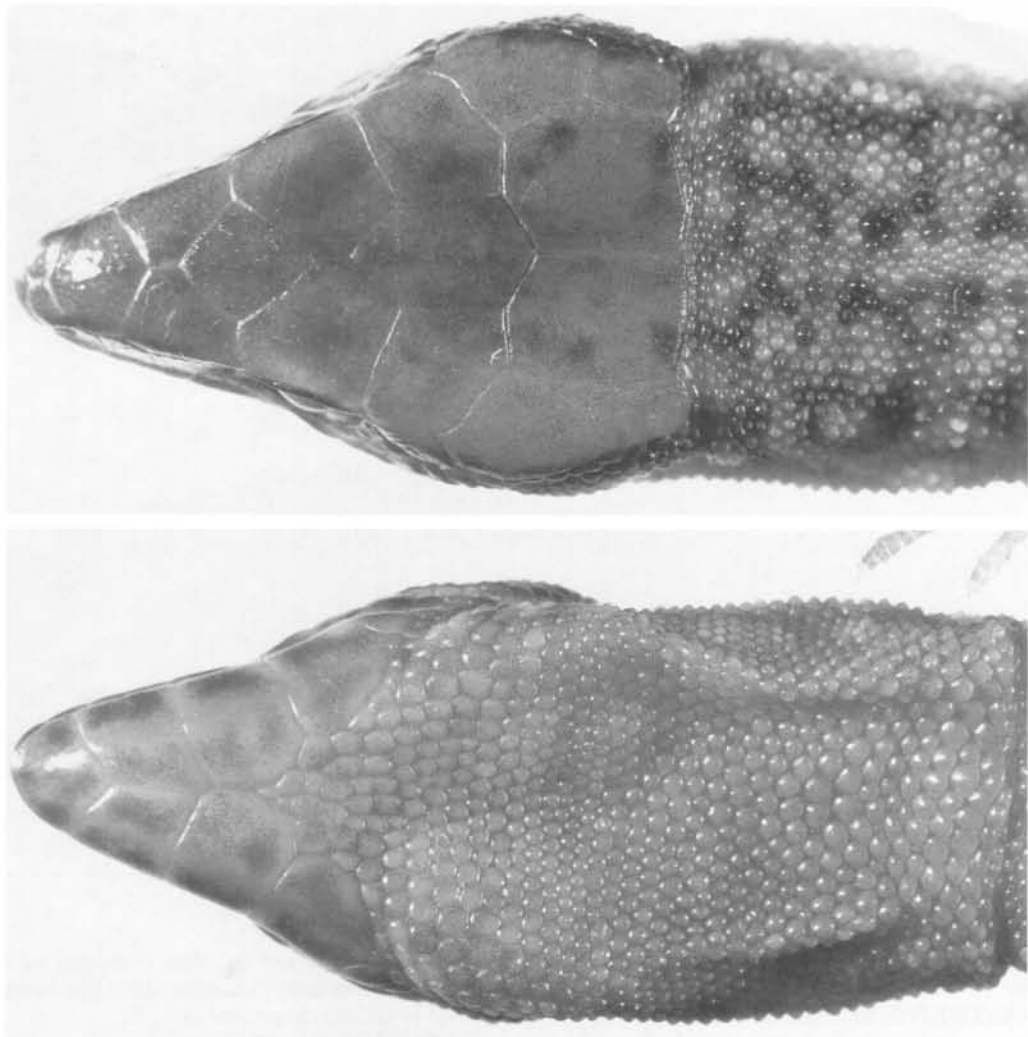


Figure 2. Dorsal (upper) and ventral (lower) views of the head of the holotype of *Lepidophyma lowei* illustrating the arrangement and relative sizes of the scales.

separated by smaller scales; 22 vertical rows of tubercles on side of body between axilla and groin; lateral tubercle rows almost in contact above with paravertebral row of tubercles.

Ventral scales flat, mostly smooth, quadrangular, in 10 longitudinal rows at midbody; lateralmost row of ventrals slightly elevated and weakly keeled, ca. two-thirds size of adjacent ventrals, and not extending to axillary region; 33 transverse rows of ventral scales between gular fold and vent, including two rows of preanals (two anterior preanals followed by four posterior preanals); lateralmost posterior preanal one-half the size of the adjacent medial posterior preanal. Scales on surfaces of limbs heterogeneous in size; dorsal surface of hindlimbs with scattered large keeled tubercles; 22 total femoral pores; 21 fourth toe lamellae (3 divided by mid-ventral suture).

Tail encircled with whorls of large tubercular keeled scales, separated dorsally by two smaller interwhorls; first (anterior) interwhorl "ring" in each caudal segment is incomplete and does not extend across ventral surface (Fig. 3); second (posterior) interwhorl ring is larger and is complete ventrally; tail (complete) contains a total of 35 caudal segments with a total of 103 dorsal annuli (whorls plus interwhorls).

Color Pattern (Fig. 1). Dorsal surface of the body with somewhat irregular dark brown and pale yellow spots on a tan background. Dorsal surface of the head is pale brown; a vague dark brown stripe extends from the rostrum through the eye to above the ear opening; labials with dark brown bars separated by pale yellow on sutures; a moderately distinct row of pale yellow spots (with dark brown borders) on the side of the neck and extending to

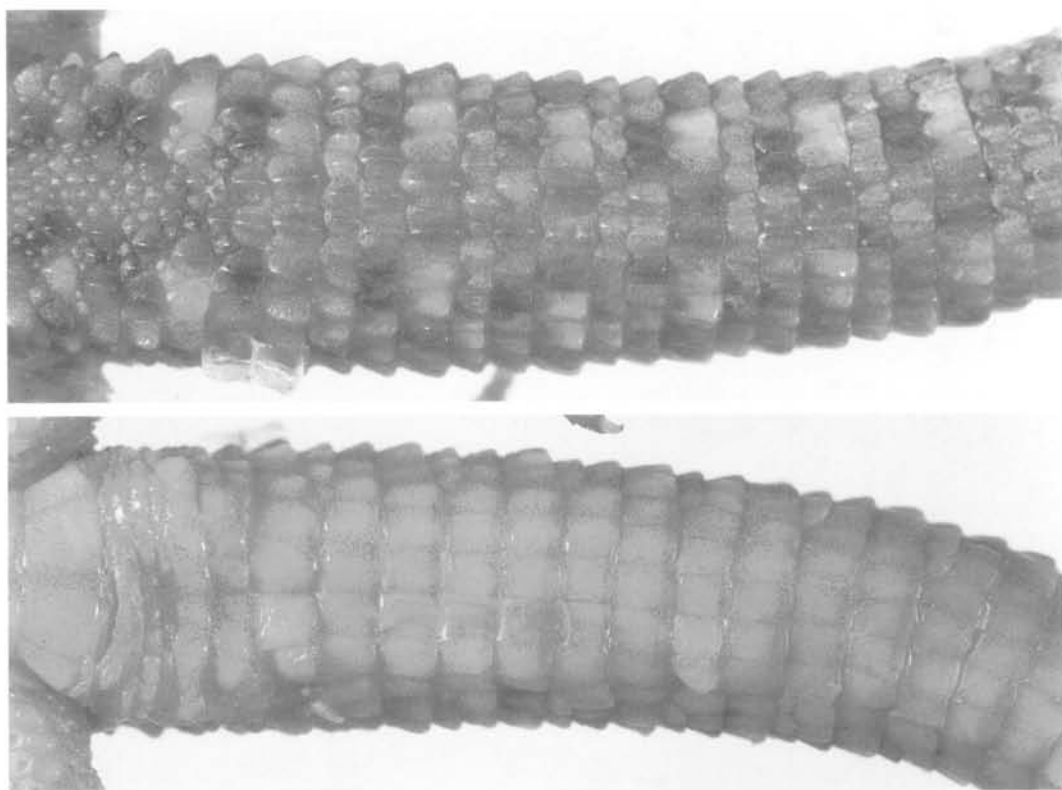


Figure 3. Dorsal (upper) and ventral (lower) views of the basal portion of the tail of the holotype of *Lepidophyma lowei* illustrating the presence of two dorsal interwhorls, only one of which is complete ventrally.

anterior third of body. Ventral surfaces grayish white.

KARYOTYPE. Based on an examination of 122 cells from 2 males and 1 female, *Lepidophyma lowei* has a diploid chromosome number of 36 consisting of 16 macro- and 20 micro-chromosomes (Fig. 4). The three largest macro-chromosomes (pair nos. 1, 2, and 6+9 following Bezy, 1972) are metacentric, pair 5 is submetacentric, and pairs 3, 4, 7, and 8 are subtelocentric. Although not visible in Fig. 4, in some of the cells a terminal secondary constriction was discernible on the long arms of chromosome pair no. 3. The karyotype of *L. lowei* appears to be identical to that of *L. smithii* Bocourt

1876 (Bezy, 1972) and to differ from that of *L. dontomasi* (Bezy and Camarillo, 1992) in having 20 (vs. 16) micro-chromosomes.

DISTRIBUTION AND HABITAT. All 16 specimens were collected within a ca. 4 km (airline) radius of San Bartolomé Zoogocho. Most were taken from rock crevices along a road-cut in pine-oak woodland (Fig. 5). The type locality is situated at ca. 2200 m elevation along a ridge above the valley of the upper Río Cajones and its tributaries. The ridge is south of the Sierra Juárez and directly across the valley of the Río Cajones from the Sierra Zempoaltepec, but appears to be more continuous in elevation and vegetation with the Sierra Aloa-

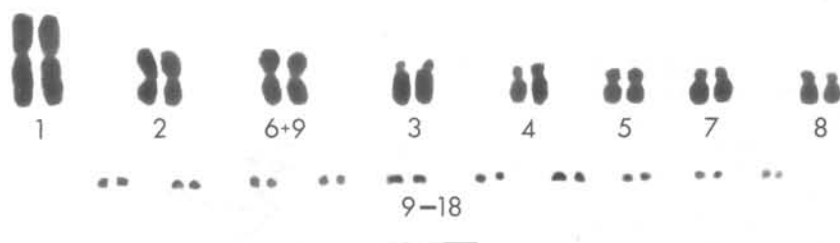


Figure 4. Karyotype of *Lepidophyma lowei* (ENEPI 3734). Line represents 10 μ .



Figure 5. Habitat at the type locality of *Lepidophyma lowei*.

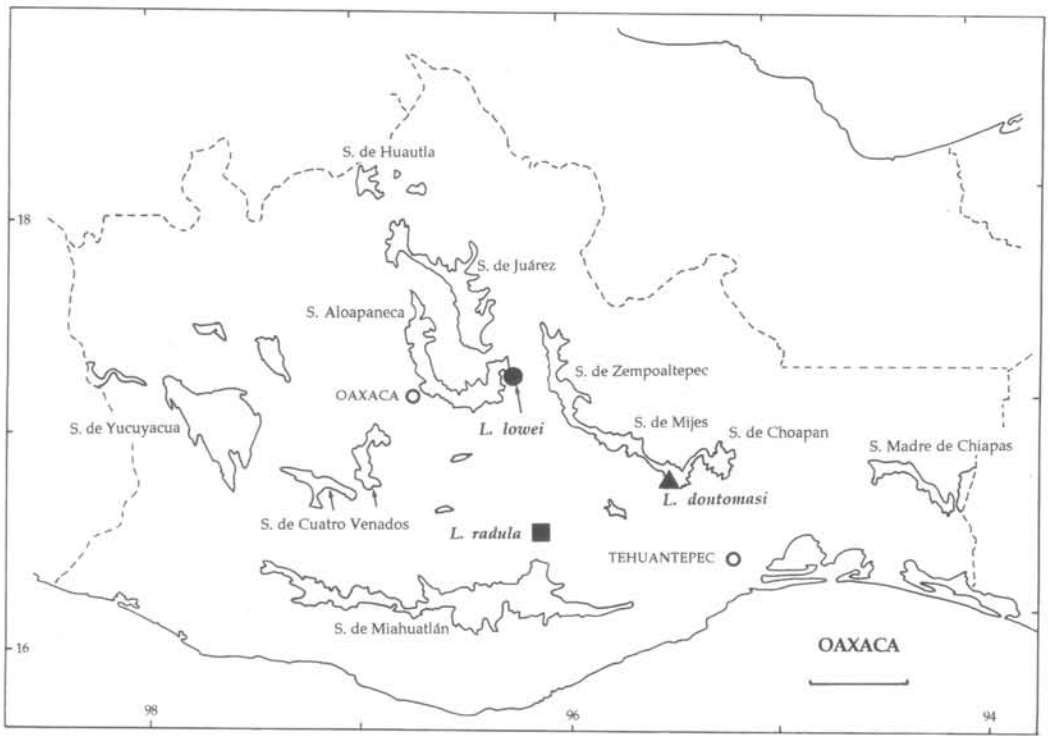


Figure 6. The distribution of the three species of the *gaigeae* group of *Lepidophyma* in Oaxaca in relation to the major mountain ranges (S. = Sierra). The map and the names and delineation of the ranges are after Binford (1989).

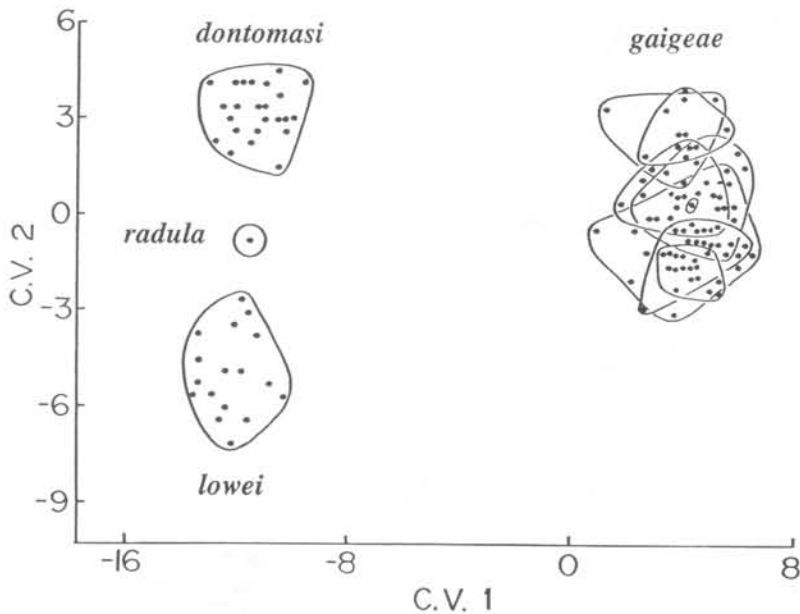


Figure 7. Specimens of the *gaigeae* group of *Lepidophyma* plotted on the first two canonical variates for 11 individual locality samples. Envelopes enclose all specimens of each sample.

Table 1. Variation in 20 scale characters for 4 species of the *Lepidophyma gaigeae* group. Sample size (*n*) is under each species. In each cell the upper figure is the mean, the middle figure is the standard error, and the bottom figures are the observed limits of variation.

Scale character	<i>lowei</i> 16	<i>dontomasi</i> 29	<i>gaigeae</i> 178	<i>radula</i> 1
FPT	24.4 0.52 22-31	19.2 0.21 17-21	33.2 0.17 28-39	20
LTR	29.0 0.26 28-31	52.2 0.62 47-60	51.8 0.47 39-73	24
DBPVR	3.31 0.10 3.0-4.0	3.62 0.07 3.0-4.0	4.12 0.03 3.0-5.0	2.5
IWD2	2.06 0.06 2-3	2.00 0.00 2	2.08 0.02 2-3	2
IWV2	1.00 0.00 1	1.00 0.00 1	1.94 0.02 1-2	1
PTMP	2.63 0.18 2-4	2.10 0.09 1-4	3.53 0.09 2-7	3
DBPVT	1.63 0.15 1.0-2.5	2.31 0.11 1.0-3.5	2.72 0.04 1.0-3.5	1.0
GC1IL	0.00 0.00 0	0.35 0.09 0-1	0.18 0.03 0-2	0
GUL	34.0 0.31 32-37	32.1 0.30 28-35	36.8 0.17 28-44	32
PVTL	24.6 0.55 21-27	20.2 0.50 15-26	10.8 0.43 0-26	24
VL	33.5 0.18 33-35	32.3 0.19 30-34	35.1 0.08 33-38	33
4TL	20.8 0.25 19-23	20.2 0.21 18-22	25.6 0.11 22-30	20
4TLD	4.4 0.44 3-7	5.0 0.20 3-7	10.4 0.18 6-17	6
DOR	163.8 1.00 158-170	140.3 1.06 128-149	136.0 0.45 121-151	135
DAPVR	87.9 1.21 82-96	70.6 0.86 62-83	66.0 0.41 53-83	69
PVR	51.9 0.90 45-60	51.0 0.72 43-61	54.4 0.50 39-74	46

Table 1. Continued.

Scale character	<i>lowei</i> 16	<i>dontomasi</i> 29	<i>gaigeae</i> 178	<i>radula</i> 1
PVS	26.6 1.33 18-38	27.6 1.29 11-45	39.1 0.93 8-72	18
PVT1	25.3 0.71 21-32	23.5 0.78 15-36	15.2 0.55 0-38	28
PVT2	23.4 0.67 18-27	12.4 0.65 6-20	4.2 0.33 0-18	23
PVT3	0.44 0.15 0-18	0.0 0.00 0	0.0 0.02 0-3	1

paneca (San Felipe) to the west (Fig. 6; Binford, 1989). Additional field work is needed in the region of the upper Río Cajones and the Sierras Aloapaneca, Juárez, and Zempoaltepec to clarify the distribution of the species.

ETYMOLOGY. The species is named for Dr. Charles H. Lowe, herpetologist, mentor, and friend.

DISCUSSION

Within *Lepidophyma*, *L. dontomasi*, *L. gaigeae*, *L. radula*, and *L. lowei* form a distinct phenetic cluster, the *gaigeae* group (Fig. 3 in Bezy and Camarillo, 1992; Smith, 1939, 1942, 1973). In addition to a smaller body size and relatively poorly differentiated tubercular scales, the four species have relatively larger (and thus fewer) dorsal, ventral, and gular scales. Whether or not this phenetic cluster represents a basal clade within the genus remains unresolved (Bezy and Camarillo, 1992).

All four members of the group are found primarily in rock-crevices in pine-oak woodland (but see Dixon et al., 1972, and González, 1995, for exceptions). The species are allopatric, each associated with a different mountain block. The most isolated is *L. gaigeae*, found in the Sierra Madre Oriental of Querétaro and Hidalgo (Bezy and Camarillo, 1992). The other members are associated with ranges in Oaxaca (Fig. 6): *L. lowei* with the Sierra de Aloapaneca, *L. dontomasi* with the Sierra de los Mijes, and *L. radula* with a northern outlier of the Sierra de Miahuatlán.

There are differences in the karyotype among the three species of the *gaigeae* group for which chromosome preparations are available. *Lepidophyma gaigeae* has a 2n of 38 with 18 macro- and 20 micro-chromosomes and is most similar in karyotype to *L. flavimaculatum* A. Duméril 1851, *L. tuxtlae* Werler and Shannon 1957, and *L. pajapanensis* Werler 1957 (Bezy, 1972). *Lepidophyma lowei* has a 2n of 36 with 16 macro- and 20 micro-chromosomes (Fig. 4) and is identical in karyotype to *L.*

smithii. *L. dontomasi* has a 2n of 32 (Bezy and Camarillo, 1992) with 16 macro-chromosomes (nearly identical to *L. lowei* and *L. smithii*) but with only 16 micro-chromosomes (a condition that is unique within the Xantusiidae).

Each of the four species of the *gaigeae* cluster is quite distinctive in scalation (Table 1; Fig. 7). In *L. gaigeae* there are two ventrally complete interwhorl rings in each caudal segment, whereas the other three species have only one (or no) interwhorl ring complete across the mid-venter. In *L. dontomasi* and *L. gaigeae*, the side of the body lacks clearly defined vertical rows of tubercles (Fig. 8 in Bezy and Camarillo, 1992), whereas *L. lowei* and *L. radula* have 24–31 lateral tubercle rows (Table 1). In *L. lowei* there are 21–31 (mean, 29.0) total femoral pores, whereas in *L. dontomasi* there are 17–21 (mean, 24.4).

The Zoogocho population shares the greatest number of similarities with *L. radula*. Due to these similarities and the fact that only two specimens were available at the time, Bezy and Camarillo (1992) tentatively assigned the population to *L. radula*. With 16 specimens now available from Zoogocho it is clear that it represents a distinct species. *Lepidophyma lowei* differs most strongly from the type of *L. radula* in having a higher number of dorsal scales between occiput and rump (158–178 vs. 135). In addition, it has more total femoral pores (22–31 vs. 20), lateral tubercle rows (28–31 vs. 24), and dorsals between the paravertebral rows (3–4 vs. 2.5) than *L. radula*.

ACKNOWLEDGMENTS

We are grateful to M. en C. Enrique Bañuelos and Ignacio Peñalosa of ENEPI for facilitation of the project; to Paula Esparza for assistance with data reduction; to Kathryn Bolles for illustration; to Dan Watson for photography; to Kathryn Bolles, Jonathan Campbell, and Hobart Smith for review of an earlier version of the manuscript; to Jonathan Campbell for helpful discussion; to Gustavo Casas-Andreu and Aurelio Ramírez-Bautista (IBH) for collection information; and to Ticul Alvarez S. (ENCB) for making specimens available. This research was partially supported by a grant from the Ralph J. Weiler Foundation.

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Received 16 July 1996; accepted 28 October 1996.