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Cnemidophorus sacki, from Michoacán, México, by William Edward
Duellman**

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*** START OF THE PROJECT GUTENBERG EBOOK A NEW SUBSPECIES OF LIZARD,
CNEMIDOPHORUS SACKI, FROM MICHOACÁN, MÉXICO ***

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Typographical Errors Corrected:

Page 589, Paragraph 2: [Tepalcatapec](#) => [Tepalcatepec](#)

Page 592, Paragraph 2: [ground color](#) => [ground-color](#)

In the original, Figure 1 had the notation X5 after the caption to let the reader know that the image was enlarged by a factor of five. As the illustration in the HTML page will display at different sizes based on the resolution of the monitor and the size the browser window, it was decided to remove that notation and the viewer would derive the measurements from the body of the paper.

[587]

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A New Subspecies of Lizard, Cnemidophorus sacki, from Michoacán, México

BY

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LAWRENCE
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A New Subspecies of Lizard, *Cnemidophorus sacki*, from Michoacán, México

BY

WILLIAM E. DUELLMAN

The systematic status of the populations of lizards assignable to *Cnemidophorus sacki* in western México (Sonora southward to Jalisco) has been reviewed in detail by Zweifel (1959, Bull. Amer. Mus. Nat. Hist, 117 (2):57-116), who stated that the use of the specific name *sacki* for the western populations rests upon a reasonable, but as yet unproved, assumption that intergradation occurs. Although Zweifel examined specimens of the nominal subspecies from the upper Balsas Basin, he did not study specimens from the intervening area—the Tepalcatepec Valley in Michoacán.

Field studies and the examination of large series of preserved specimens of *Cnemidophorus* from the [Tepalcatepec](#) Valley show the presence of *Cnemidophorus sacki* in the region between the ranges of *C. sacki sacki* in the upper Balsas Basin and *C. sacki occidentalis* in Jalisco and southern Nayarit. Furthermore, the populations of *sacki* inhabiting the Tepalcatepec Valley have characters of scutellation and coloration that distinguish them from other described subspecies of *sacki*. In recognition of the important contributions to the systematics of the genus *Cnemidophorus* made by Dr. Richard G. Zweifel, I propose that the subspecies of *Cnemidophorus sacki* in the Tepalcatepec Valley be named as follows:

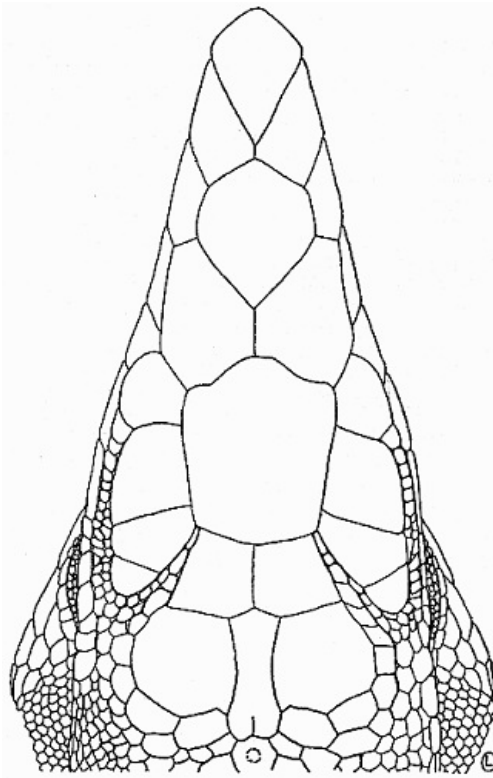
***Cnemidophorus sacki zweifeli* new subspecies**

Holotype.—University of Michigan Museum of Zoology No. 119542, from Capirio, Michoacán, México (185 meters), an adult male, one of a series collected on June 13, 1958, by William E. Duellman, Jerome B. Tulecke, and John Wellman. Original number WED 12310.

Paratopotypes.—UMMZ Nos. 119536-119541 and 119543-119550.

Diagnosis.—A race of *Cnemidophorus sacki* characterized by large size (more than 130 mm. snout-vent length in males), approximately 106 dorsal granules around the midbody, about 41 femoral pores, and a dorsal color-pattern in adult males consisting of lateral and dorsolateral rows of spots, paravertebral rows fused with middorsal light green area at least anteriorly, and pink throat having a median light blue spot or transverse band.

Description of Holotype.—Snout-vent length, 128 mm.; tail length, 252 mm.; tail/body ratio, 1.97; scutellation typical of *sacki*—four supraoculars, enlarged postantibrachials, and enlarged mesoptychials; 107 granules around midbody (excluding enlarged ventrals); 45 femoral pores; three enlarged preanal scales; supraorbital semicircle-series extending anteriorly to posterior edge of frontal ([Fig. 1](#)).



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FIG. 1. Top view of the head of the holotype of *Cnemidophorus sacki zweifeli* (UMMZ 119542) showing scutellation.

Top of head and nape dusty brown; tip of rostral and lateral edges of superciliaries dark cream-color; upper labials and sides of head anterior to eyes cream-color, mottled with blue; lower labials and postocular region pale blue; mental, postmental, and sublabials cream-color. Upper surfaces of forelimbs dull bluish gray, spotted with pale greenish yellow; dorsal surfaces of proximal one-fourth of tail light brownish gray turning to pale orange-brown posteriorly; lateral surfaces of tail bluish gray anteriorly and creamy brown posteriorly. Nuchal region light bluish gray; flanks dark gray; dorsal ground-color dark brown, somewhat paler posteriorly. Body having a row of cream-colored spots in place of a lateral stripe, and another row in place of dorsolateral stripe; dorsally, large diffuse tan or light green spots partially fused and tending to form irregular transverse markings. Chin to posterior end of sublabials pale pink, bordered posteriorly by bluish white area, and then pink. Mesoptychials, under surfaces of hind limbs, and belly cream-colored; anterior edges of belly scales dark blue; lateral two rows of ventrals on posterior two-thirds of body dark blue having light blue or cream-colored spots. Under surfaces of forelimbs bluish cream; ventral surface of tail cream-colored.

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Variation in Size and Scutellation.—The largest male has a snout-vent length of 132 mm., the largest female, 114 mm., and the smallest juvenile, 34 mm. The number of dorsal granules at the midbody varies from 91 to 117 (106.2 ± 0.43); the ratio of the number of granules between the paravertebral stripes to the number of granules around the body (PV/GAB) varies from 0.064 to 0.157 (0.097 ± 0.007); the number of femoral pores varies from 32 to 49 (41.1 ± 0.20). Usually there are only three enlarged preanals, but 18 specimens have a somewhat enlarged scale anterior to the normal complement of three. In 15 specimens the supraorbital semicircle-series terminate short of the posterior edge of the frontal; in the others the series reach the frontal.

Variation in Coloration.—The coloration of juveniles and subadults varies little; large adults vary considerably especially in the amount of diffusion of the light green middorsal area. In some individuals the vertebral pale area does not include the paravertebral spots; in other individuals the pale area includes not only the paravertebral rows, but, at least anteriorly, the dorsolateral rows. In large males of about equal size (and collected at the same time) there is considerable variation in the amount of blue on the belly. In a few of the males the belly is white with only the anterior edge of each scale blue; in some only the lateral rows of ventrals on the posterior two-thirds of the body are blue; in others all of the posterior two-thirds of the belly is blue.

Ontogenetic Change in Color Pattern.—The metamorphosis of color pattern in *Cnemidophorus sacki zweifeli* results in the dorsal ground-color becoming paler with age, the replacement of the stripes by spots, and finally in large males the suffusion of these spots.

A single hatchling (UMMZ 114732) is available; this specimen has a prominent umbilical scar and a snout-vent length of 34 mm. The top of the head is olive brown; the dorsal surfaces of the limbs are dark brown with cream mottling; the dorsal ground-color is brownish black; this is paler on the lower flanks. The lateral and dorsolateral stripes are cream-colored; the paravertebral stripes are white. There is a faint, diffuse vertebral stripe anteriorly (Fig. 2 A). The throat and undersides of the limbs and tail are cream-colored; the belly is bluish white. In life the stripes were pale yellowish green, and the tip of the tail was pink.

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In larger individuals the dorsal [ground-color](#) is dark brown; the lower flanks are grayish tan. Light brown diffuse spots are present in the lateral and dorsolateral dark fields. The tan vertebral stripe is diffuse and nearly fills the paravertebral dark fields; the paravertebral stripes are faint

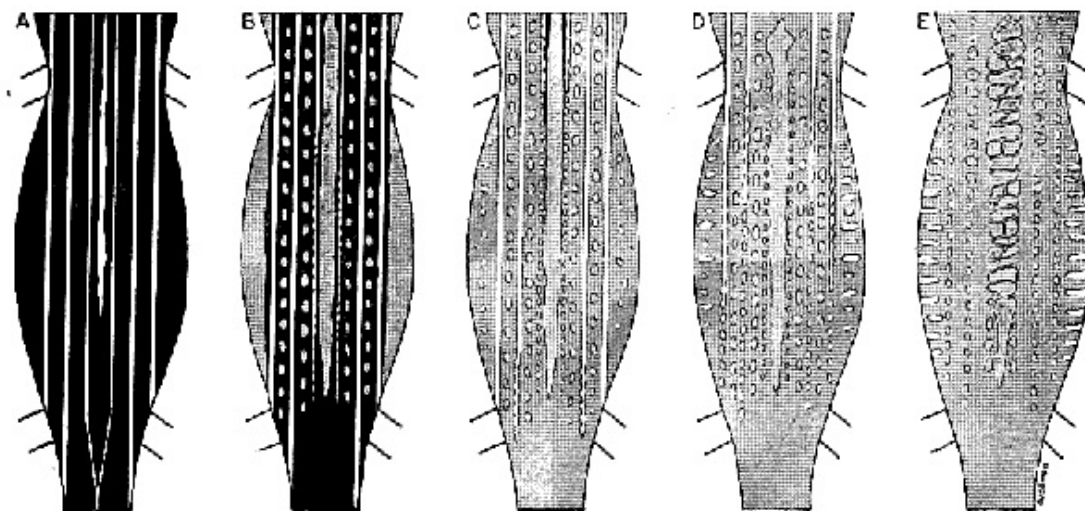
posteriorly; throughout their length they are scalloped—the beginning of their fragmentation into spots (Fig. 2 B).

In subadults (± 80 mm. snout-vent length) the paravertebral stripes are fragmented into spots posteriorly. Also, the dorsolateral stripes in some individuals are fragmented posteriorly. The dorsolateral dark fields are somewhat paler than the lateral dark fields. Cream-colored spots are present on the flanks. The mottling on the thighs tends towards the formation of light spots (Fig. 2 C).

In small adults (± 100 mm. snout-vent length) the paravertebral stripes are entirely fragmented into spots. The lateral and dorsolateral stripes are broken into spots posteriorly. The middorsal pale area (formed by the suffusion of the vertebral stripe) and paravertebral and dorsolateral rows of spots are pale green. The cream-colored spots on the flanks are expanded to form vertical bars (Fig. 2 D).

Large adult males (± 120 mm. snout-vent length) have all of the stripes fragmented into spots. The diffuse middorsal area is expanded and encloses the paravertebral rows of spots. The pale spots present in the dark fields in smaller individuals are either absent or fused with spots resulting from the fragmentation of the stripes (Fig. 2 E).

Sexual dimorphism.—Males attain a larger size (known maximum snout-vent length of 132 mm., as compared with 114 mm. in females). Males have larger but not more numerous, femoral pores, blue bellies, and pink and blue throats, whereas females are unicolor creamy white ventrally. The more nearly complete metamorphosis of color pattern exhibited by adult males probably is correlated with their large adult size. Large females retain complete lateral and dorsolateral stripes. The jowls of breeding males are swollen.



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FIG. 2. Diagrammatic representation of ontogenetic change in color pattern in *Cnemidophorus sacki zweifeli*: A—hatchling, 34 mm. snout-vent length; B—juvenile, 55 mm. snout-vent length; C—subadult male, 80 mm. snout-vent length; D—small adult male, 100 mm. snout-vent length; E—large adult male, 120 mm. snout-vent length.

Geographic variation.—No noticeable geographic variation in this subspecies is evident in the series from the Tepalcatepec Valley. However, lizards from eastern Michoacán (Chinapa, 6 km. N of Tafetan, 6 km. S of Tzitzio, and 19 km. S of Tzitzio) differ slightly from those from the Tepalcatepec Valley; the eastern specimens have fewer dorsal granules and femoral pores, and a higher ratio of dorsal granules between the paravertebral stripes to the number of granules around the body (see Tables 1-3). No large adult males are present in the eastern series; the subadults and small adult males have color patterns like lizards of similar size from the Tepalcatepec Valley. The largest male from the east has a snout-vent length of 110 mm., rows of pale spots, and no trace of brown and tan cross-bars. Specimens of *Cnemidophorus sacki sacki* of equal size from Guerrero, Morelos, and Puebla in the upper Balsas Basin have a tan dorsum with dark brown cross-bars. The localities in eastern Michoacán are intermediate geographically between the Tepalcatepec Valley and the known range of the nominal subspecies in the upper Balsas Basin. In characters of scutellation specimens from the east are intermediate between *C. sacki sacki* and *C. sacki zweifeli* in the Tepalcatepec Valley. However, in coloration the lizards from the east are like those from the Tepalcatepec Valley, but differ distinctly from the nominal subspecies. Therefore, the eastern series is referred to the subspecies *C. sacki zweifeli*.

Comparisons.—Four other species of *Cnemidophorus* occur in the Tepalcatepec Valley with *Cnemidophorus sacki zweifeli*. Of these, *C. calidipes* has a maximum snout-vent length of 79 mm., 66 to 86 dorsal granules, and a light brown dorsum with pale blue spots and vertical bars; *C. communis communis* has a maximum snout-vent length of 135 mm., 105 to 144 dorsal granules, and a greenish tan dorsum with yellow spots; *C. deppei infernalis* has a maximum snout-vent length of 84 mm., 91 to 120 dorsal granules, and a striped pattern throughout life; and *C. lineatissimus exoristus* has a maximum snout-vent length of 98 mm., 108 to 135 dorsal granules, and a middorsal yellow stripe and vertical bars on the flanks. Both *calidipes* and *communis* are like *sacki* in possessing four enlarged supraoculars and enlarged postantibrachials, whereas *deppei* and *lineatissimus* have three enlarged supraoculars and granular postantibrachials. Juveniles of *calidipes* and *sacki* are alike in coloration but different in the extent of the supraorbital semicircle-series. In *calidipes* the supraorbital semicircle-series usually are complete, whereas in *sacki* the series never extended anterior to the posterior edge of the frontal.

TABLE 1.—VARIATION IN THE NUMBER OF DORSAL GRANULES
IN THREE SUBSPECIES OF CNEMIDOPHORUS SACKI

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Key for Table:

No. = Number of Specimens
SE = Standard Error

SD = Standard Deviation
C/V = Coefficient of Variation

POPULATION	No.	Range	Mean	SD	SE	C/V
<i>sacki sacki</i>						
Entire Sample	106	88-105	96.3	4.16	0.40	3.92
Puebla: Tehuitzingo	22	88-103	95.1	4.18	0.89	4.39
Guerrero: Chilpancingo	23	90-105	95.8	3.86	0.80	4.02
Guerrero: Mexcala	22	90-102	96.5	3.56	0.76	3.69
Morelos	39	89-105	97.2	4.56	0.73	4.69
<i>sacki zweifeli</i>						
Entire Sample	191	91-117	106.2	5.98	0.43	3.13
Michoacán: Tafetan	21	91-116	101.4	8.04	1.75	7.92
Michoacán: Apatzingán	170	95-117	106.8	5.42	1.32	3.19
<i>sacki occidentalis</i> [A]	62	97-118	106.3	4.72	0.60	7.61

[A] Data for *C. sacki occidentalis* in Tables 1-3 are from Zweifel (1959, Bull. Amer. Mus. Nat. Hist., 117: tables 1-3).

TABLE 2.—VARIATION IN THE NUMBER OF FEMORAL PORES
IN THREE SUBSPECIES OF CNEMIDOPHORUS SACKI

Key for Table:

No. = Number of Specimens
SE = Standard Error

SD = Standard Deviation
C/V = Coefficient of Variation

POPULATION	No.	Range	Mean	SD	SE	C/V
<i>sacki sacki</i>						
Entire Sample	106	32-44	36.2	2.42	0.25	2.28
Puebla: Tehuitzingo	22	33-41	36.7	2.36	0.50	6.43
Guerrero: Chilpancingo	23	32-39	35.7	2.15	0.45	6.02

Guerrero: Mexcala	22	33-44	37.5	2.59	0.55	6.91
Morelos	39	32-40	35.4	2.19	0.35	6.18
<i>sacki zweifeli</i>						
Entire Sample	189	32-49	41.1	2.77	0.20	1.46
Michoacán: Tafetan	19	33-43	38.1	2.61	0.60	6.85
Michoacán: Apatzingán	170	2-49	41.4	2.58	0.62	1.52
<i>sacki occidentalis</i>	67	32-45	38.8	2.46	0.30	3.67

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TABLE 3.—RATIO OF NUMBER OF GRANULES SEPARATING PARAVERTEBRAL STRIPES TO GRANULES AROUND MIDBODY (PV/GAB) IN THREE SUBSPECIES OF *CNEMIDOPHORUS SACKI*

Key for Table:

No. = Number of Specimens
SE = Standard Error

SD = Standard Deviation
C/V = Coefficient of Variation

POPULATION	No.	Range	Mean	SD	SE	C/V
<i>sacki sacki</i>						
Entire Sample	72	0.101-0.205	0.154	0.052	0.006	0.073
Puebla: Tehuizingo	12	0.140-0.205	0.169	0.052	0.015	0.433
Guerrero: Chilpancingo	16	0.120-0.192	0.157	0.021	0.005	0.131
Guerrero: Mexcala	21	0.142-0.180	0.159	0.031	0.007	0.147
Morelos	23	0.101-0.180	0.137	0.023	0.005	0.100
<i>sacki zweifeli</i>						
Entire Sample	105	0.064-0.157	0.097	0.070	0.007	0.067
Michoacán: Tafetan	21	0.103-0.157	0.128	0.039	0.009	0.186
Michoacán: Apatzingán	84	0.064-0.126	0.089	0.051	0.005	0.060
<i>sacki occidentalis</i>	50	0.086-0.183	0.130	0.021	0.003	0.042

From the geographically adjacent populations of *sacki* (*sacki* and *occidentalis*), *zweifeli* differs in coloration and scutellation (see Tables I-III). *Cnemidophorus sacki sacki* has a dorsal pattern in adult males of dark brown cross-bars on a tan ground-color. Both *occidentalis* and *zweifeli* have variable, diffuse color patterns in large adults, but *zweifeli* differs from *occidentalis* in having a blue spot on the pink throat.

Ecology.—In the arid Tepalcatepec Valley *Cnemidophorus sacki zweifeli* lives at elevations of 160 to 1300 meters. In the lower parts of the valley the lizards live primarily in open scrub forests, characterized by deciduous trees offering only partial shade from the sun, especially during the prolonged dry season. Common trees in this scrub forest are *Acacia cymbispina*,

During the dry season (November through May) adult males apparently aestivate; several large series collected in the winter include only subadults and females. This absence of males is corroborated by personal observations in the Tepalcatepec Valley in April and May. In the summer rainy season the lizards are active in the morning and again in the late afternoon; only *Cnemidophorus calidipes* is active during the heat of the midday. In some areas of the scrub forest *Cnemidophorus sacki zweifeli* is found in association with *Cnemidophorus communis*. Throughout the scrub forest *C. sacki zweifeli* occurs with *C. deppei infernalis*. In some of the more dense scrub forest, where *C. sacki zweifeli* is not so abundant as in the more open forest, it has been taken with *C. lineatissimus exoristus*. In the open *Acacia-Cercidium* associations on the valley floor *C. sacki zweifeli* occurs with *C. calidipes*.

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This subspecies is not restricted to the scrub forest. On the lower slopes of the Cordillera Volcanica in Michoacán *C. sacki zweifeli* has been collected in open pine-oak forest near Zirimicuaro and Ziracuaretiro.

Distribution.—*Cnemidophorus sacki zweifeli* inhabits the valley of the Río Tepalcatepec in Michoacán and probably extreme southwestern Jalisco, and the western part of the Balsas Basin in Michoacán. No specimens have been seen from extreme western Guerrero, but *C. s. zweifeli* may occur there.

Specimens examined.—Catalogue numbers are preceded by abbreviations of the name of the institution as listed in the acknowledgements.

Cnemidophorus sacki occidentalis, 22 specimens, as follows: *Jalisco*: 8 km. E of Ameca, UMMZ 102045; 7 km. SE of Ameca, UMMZ 102046; Autlán, UMMZ 102044, 102219-21; 7 km. ESE of El Arenal, UMMZ 114736 (2); San Gabriel, UMMZ 102040, 102042-3. *Michoacán*: 2 km. ESE of Jiquilpan, UMMZ 117557 (3). *Nayarit*: Ixtlán del Río, UMMZ 104747; San José de la Conde, UMMZ 102047 (4); 5 km. N of Santa Isabel, UMMZ 102048-50.

Cnemidophorus sacki sacki, 108 specimens, as follows: *Guerrero*: Chilpancingo, UMMZ 72426 (8), 73937 (7), 88422 (4); 8 km. W of Chilpancingo, UMMZ 119144 (4); 5 km. N of Iguala, UMMZ 114712 (11); 15 km. N of Iguala, UMMZ 99039; Mexcala, UMMZ 114711 (10); 8 km. S of Taxco, UMMZ 114709 (2). *Morelos*: Amacuzac, UMMZ 114716; 3 km. S of Cuautla, UMMZ 99031 (9), 99917 (11); Río Cuautla, UMMZ 99038 (6); 5 km. S of Temixco, UMMZ 114718 (12); *Puebla*: 5 km. SE of Izúcar de Matamoros, UMMZ 112650 (4); 13 km. SE of Izúcar de Matamoros, UMMZ 117497 (2); 3 km. NW of Tehuizingo, UMMZ 114714 (10); 1 km. N of Teyuca, UMMZ 114713 (6).

Cnemidophorus sacki zweifeli, 207 specimens, as follows: *Michoacán*: Apatzingán, CNHM 36966-8, 38969, 38971 (18), 38972 (50), UIMNH 36772-7, USNM 135967-8, 135970, 135972-3; 4 km. E of Apatzingán, UMMZ 85412; 6.5 km. E of Apatzingán, UMMZ 114731 (5); 5 km. W of Apatzingán, KU 29289-90, 29293-7; 10 km. W of Apatzingán, UMMZ 114730 (4); 12.3 km. S of Apatzingán, UMMZ 112647; 16 km. S of Apatzingán, KU 29298; 14 km. SSW of Apatzingán, KU 29735, 29746, 29750-2; 10 km. W of Buenavista, UMMZ 114719 (3); Capirio, UMMZ 112643, 114722 (2), 114733, 119536-50; 4 km. N of Capirio, UMMZ 112644 (3), 112645; 5.6 km. N of Capirio, UMMZ 114732; 2 km. S of Charapendo, UMMZ 112639 (12); Chinapa, UMMZ 119556 (2); Jazmin, UMMZ 114725 (2); between La Playa and Volcán Jorullo, UMMZ 104748 (2); Limoncito, UMMZ 119552 (3); 14 km. S of Lombardia, KU 29299-301, 29303, 29305-11; 6 km. SW of Nueva Italia, UMMZ 112640 (2); 2.7 km. S of Nueva Italia, UMMZ 112641 (4); 5 km. N of Nueva Italia, UMMZ 114721; Río Marquez, 10 km. S of Lombardia, UMMZ 112642, 112646; Río Marquez, 13 km. SE of Nueva Italia, UMMZ 114726; 6 km. N of Tafetan, UMMZ 119555 (18); 14.5 km. E of Tepalcatepec, UMMZ 114720 (2); 6 km. S of Tzitzio, UMMZ 99199, 99200 (2); 19 km. S of Tzitzio, UMMZ 99154; Volcán Jorullo, UMMZ 104449 (4), 104750; Ziracuaretiro, UMMZ 114724; 3 km. NW of Zirimicuaro, UMMZ 114723.

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