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NOTES ON GEOGRAPHIC DISTRIBUTION, HABITAT, AND TAXONOMY OF SOME MEXICAN MAMMALS

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DURING the period, June through August, 1963, a small field party from the University of Michigan Museum of Zoology collected mammals from selected localities in the highlands of México. Our efforts concentrated on obtaining data on *Sciurus* and *Peromyscus*. Much of that data is being used in a systematic review of Mexican tree squirrels now in progress. Information on the glans penis of some of the species of *Peromyscus* that were obtained has been published elsewhere (Hooper and Musser, 1964). New information on geographic distribution, habitat, and taxonomy of some other mammals collected, exclusive of *Sciurus,* is presented below.

I am grateful to E. R. Hall and R. H. Manville for the loan of specimens in their care; to W. H. Burt and E. T. Hooper for graciously opening to me all facilities at the Museum; and to Sr. Dr. Rodolfo Hernández Corzo, of the Dirección General de Caza, Departamento de Conservatión de la Fauna Silvestre, Secretaría de Agricultura y Granadería, for providing necessary collecting permits. The excellent illustration is the work of Suzanne Runyan, staff artist of the Museum of Zoology.

In the accounts of species, which follow the list of collecting localities, all measurements are in millimeters; capitalized color terms are those of Ridgway (1912).

COLLECTING LOCALITIES

The following localities are arranged alphabetically by state and by collecting station within that state. Mileages are by road unless otherwise indicated. Airline distances were taken from topographic maps (1:500,000) issued by the Comisión Intersecretarial Coordinadora

del Levantamiento de la Carta Geográfica de la República Mexicana. Altitudes are from our altimeter; the error may equal several hundred feet for some localities.

GUERRERO

Puerto Chico: A collecting station at 8400 feet elevation in the mountains west of Chilpancingo. It is one of a series of landmarks, used by a lumbering company, along a road that begins in the lowlands at Casa Verde (about 20 miles north of Chilpancingo on Highway 95) and ascends southwest to elevations exceeding 9000 feet. Puerto Chico, 63 kilometers by road southwest of Casa Verde, is in a canyon near the upper limit of cold, wet, cloud forest. Although the forest has been cut over, many towering oaks still remain and dominate the lower secondary growth. The oaks, festooned with bromeliads and other epiphytes, are the major trees, but pine and fir are scattered throughout the forest on north-facing, protected slopes. Jagged limestone castles and cliffs form the structural foundations of the canyon. These rock masses, honeycombed with solution tunnels and pits, are covered by moss and lush vegetation and are almost hidden in the shadows of the forest. A lush growth of herbaceous plants, ferns, and shrubs comprises the ground cover along the canyon bottom and in the disturbed areas along the road fill. Piles of brush and rotting logs are scattered over the forest floor. Above Puerto Chico, as Goldman (1951:153) indicated for nearby localities, the humid, cold, dense forest thins out, giving way to pine and fir.

HIDALGO

El Potrero: A small village, elevation 6600 feet, about 13 miles northeast of Metepec on the Metepec-Tenango de Doria highway. Climate and vegetation are similar to that occurring southwest of Huauchinango at a comparable elevation. Near El Potrero, towering oaks, some with trunks exceeding four feet in diameter, dominate a broadleaf forest interspersed with pine and alder. Bromeliads, moss, and other epiphytic growths cover the oaks and alders. The forest floor is covered with a deep layer of wet oak leaves and humus, and rotting, moss-covered stumps and logs. Lush herbaceous vegetation, (shrubs, ferns, and grasses) forms the ground cover along the sides of stream-cut ravines, the barrow pits between road and forest, and the moist areas around water seeps along the base of nearby limestone cliffs. Conifers predominate on the rugged, steep slopes below the

village. In the period 26 June to 3 July, the area was generally enshrouded in clouds and soaked with daily late-morning and afternoon rains.

NUEVO LEÓN

Southwestern Nuevo León: Specimens are from the desert 12 miles north of Matehuala adjacent to the Matehuala-Saltillo highway, elevation 5900 feet. Ledgerock is exposed along the sides of shallow arroyos. The area is heavily grazed by goats.

OAXACA

Campemento Río Molino: A highway maintenance station, about 7300 feet elevation, on the Miahuatlán-Puerto Angel highway approximately three miles south of San Miguel Suchixtepec in the high mountains of southern Oaxaco. We worked in the canyon above and below the encampment. The higher slopes of the canyon north of the encampment are relatively dry and covered with cut-over oak and pine forest. In contrast, bromeliad-covered, scattered oaks and other broadleaf trees form a broken canopy over moss-covered rotting logs overgrown with shrubs, large ferns, and dense herbaceous vegetation in the canyon bottom adjacent to the road. A small stream courses through the canyon and joins the Río Molino near the encampment. The canyon bottom south of the encampment is more exposed and is much drier.

Cerro San Felipe: We spent one night near the summit of this peak located northeast of Oaxaca de Juárez. Goldman (1951:208–9) described the area in detail.

Jalatengo: A small village below Campemento Río Molino on the Miahuatlán-Puerto Angel highway. Our collecting station was in the coffee zone four miles south of the village at about 5000 feet elevation. Here we trapped in a steep, densely vegetated ravine adjoined on each side by coffee groves. Slopes of a nearby major canyon, where coffee groves were absent, were covered with tropical broadleaf forest.

Sierra de Juárez: A northern projecting spur of the highland mass north of Oaxaca de Juárez. A road north of Ixtlán de Juárez follows along the crest of the Sierra to Cerro Pelon where it descends to the tropical lowlands through Valle Nacional to Tuxtepec near the Oaxaca-Veracruz border. Between Ixtlán and the Cerro, we collected at the following stations: four miles southwest of Llano de las Flores,

elevation 8700 feet; just north of the Llano, elevation 9500 feet; and 13 miles northeast of the Llano on the upper slopes of Cerro Pelon, 9200 feet elevation.

Collections from southwest and north of Llano de las Flores are from cloud forests of oak and conifer as described by Hooper (1961). At Cerro Pelon, the forest is predominantly oak, with some pine and fir. The oaks are draped with bromeliads, lacy curtains of moss, and other epiphytes. Many of the conifers have been removed by logging operations, but most of the oaks stand; currently they are protected by the Mexican Government. Above 9200 feet the forest thins, giving way to short conifers and shrubs. During our stay on the slopes of the Cerro, for approximately one week, clouds enshrouded the area; rain was continual except for several hours in the morning, and temperatures were near freezing at night. Local residents indicated that these weather conditions are typical of the area during the wet season. They also report that a snow cover usually persists from October through February; subfreezing temperatures are common.

PUEBLA

Crus Alta: A local landmark in the rugged mountains of northern Puebla 4–5 miles south of Aquixtla, elevation 9000 feet. Moist oak and pine forest covers the slopes, giving way to small stands of tall fir in sheltered, north-facing ravines and canyons. Large fallow fields, studded with gopher workings, break up the forest.

Rancho Ocotal Colorado: The property of Manuel Antonio Huerta, this ranch lies in a small valley about two miles east of Crus Alta, elevation 8800 feet. Most of the valley floor and slopes are cultivated; interspersed between the fields are patches of dry oak-pine forest. About 10,000 feet and above, north-facing slopes are covered with fir, mixed with oak and pine. Higher, the forest surrounds large alpine meadows.

SAN LUIS POTOSÍ

Tamazunchale: We worked two miles west of Tamazunchale on the Pan American highway, elevation 600 feet. Here a steep, narrow canyon descends to the Río Moctezuma. Its stream-scoured bottom contained several small pools, but was otherwise dry. The lower walls of the canyon were formed by exposed rock outcrops; higher slopes supported tropical broadleaf forest.

TAMAULIPAS

El Carrizo: A small village on the Pan American highway approximately 42 miles south of Ciudad Victoria. We worked in a canyon about three miles west of the village in tropical deciduous forest, 1500 feet elevation. Martin (1958) gave details on the biogeography of the area.

Guayabos: A ranchero at 1500 feet elevation on the eastern foothills of the Sierra Madre Oriental, approximately 19 airline miles west of El Barretal in northwestern Tamaulipas. Vegetation is primarily dense thorn forest broken by broadleaf gallery forest along the nearby southern tributary of the Río Blanco.

VERACRUZ

Huayacocotla: Located in western Veracruz near the Veracruz-Hidalgo boundary, Huayacocotla is a large town at the terminus of Highway 51; this highway provides access to Huayacocotla from Tulancingo through Metepec and Los Jacates. We worked two miles southeast of the town at 6500 feet altitude in wet, cool oak and pine forest. Much of the forest has been cut over and beneath the remaining trees is a dense understory of secondary growth and piles of rotting, moss-covered logs. Ferns and dense shrubbery make up the ground cover along sheltered water courses and seeps from the base of moss-encrusted limestone cliffs.

La Joya: A small village at 6600 feet elevation in moist, cool oak and pine forest on the Las Vigas-Acajete highway.

ACCOUNTS OF SPECIES

Sorex veraepacis mutabilis Merriam.—Two adult specimens: one female, trapped in an open runway under low vegetative cover in cool, wet oak and conifer forest near Puerto Chico, Guerrero, 8400 ft.; one male taken alongside a rotting log in wet oak and pine forest near Llano de las Flores, Oaxaca, 9500 ft.

The Oaxacan example agrees well with Jackson's (1928:151) description of *mutabilis*; the Guerreran specimen, although similar to the Oaxacan *mutabilis* in external dimensions, has much darker underparts and tail. The skull, measurements (explained by Jackson, 1928:13) of which follow, is larger: condylobasal length, 19.0; palatal length, 8.3; cranial breadth, 10.0; interorbital breadth, 4.4; maxillary breadth, 5.9; length of maxillary tooth row, 7.2. These values are

more comparable to those of *S. macrodon* (*op. cit.*:153) or to those of a specimen of *veraepacis* from near Omilteme, Guerrero (Davis and Lukens, 1958:349), than to the Oaxacan *mutabilis*. These data support the hypothesis that *veraepacis* in the highlands of Guerrero is distinct (*ibid.*), at least from those populations occurring in the highlands of northern Oaxaca.

Sorex saussurei oaxacae Jackson.—Two adult males were taken in a wide runway at the base of a moist, moss-covered rock outcrop near Campemento Río Molino, Oaxaca, 7300 ft. Ferns comprise a large part of the lush herbaceous ground cover. *Cryptotis mexicana* and *Peromyscus megalops* were taken in the same habitat.

Apart from the type of *oaxacae* (see Jackson, 1928:157), these specimens apparently are the only other known examples of *S. saussurei* from the mountains of southern Oaxaca. The name *oaxacae* is applied to them primarily on the basis of geography and color. Both specimens, in wet-season (August) pelages, are more deeply pigmented (upperparts between Mummy Brown and Prout's Brown) than are examples, in comparable pelages, of *S. s. saussurei* from Distrito Federal and Michoacán; the underparts are slightly paler, hardly contrasting with the upperparts, and the feet and tail are much darker than in specimens of *saussueri*. The brain case of the only undamaged skull of the Oaxacan specimens is slightly more vaulted and narrower than the majority of *saussurei*. More specimens of *oaxacae* are required to assess the taxonomic significance of variation in cranial features.

Cryptotis mexicana machetes Merriam.—One specimen was obtained from wet leaf litter and humus on a moist, densely vegetated streamside near Campemento Río Molino, Oaxaca, 7300 ft.

Apparently this is the second locality record of *C. mexicana* from the highlands of southern Oaxaca. Geographically, the example is referable to *machetes* (Merriam, 1895*b*:26). In features of skin and skull, however, it falls within the range of variation in specimens of *C. m. mexicana* from highlands in northern Oaxaca, Puebla, and Veracruz.

Cryptotis magna Merriam.—One adult male trapped in a runway located in wet, dense herbaceous cover at the bottom of a road cut on the south slope of Cerro Pelon, Oaxaca, 9200 ft., provides the third record of the species. The forest cover consists of large oaks with scattered conifers. On successive nights *Microtus mexicanus* and *Peromyscus lepturus* were trapped in the same runway as the shrew.

The specimen fits Merriam's (1895*b*:28) description of *magna*.

External and cranial measurements are comparable, although length of skull (22.8 mm.) is slightly less than that recorded for the type of *magna*. The chestnut wash on the throat which Merriam thought might be stain in his material is not evident in my specimen. Among examples of other species of *Cryptotis*, the Cerro Pelon specimen approaches only *C. goodwini* (August-taken specimens from Cumbre María Tucum, Guatemala) in size and color, but it differs strikingly from that form in having darker hind feet; tail longer (50 per cent of head and body instead of 35 per cent in *goodwini*), darker and less pilose; and larger skull and teeth, but relatively narrower interorbital region. The longer rostrum and palate and the more vaulted cranium in *magna* are especially diagnostic. Judging from the one specimen, and from Merriam's (*ibid.*) description, large size and long tail appear distinctive for *magna*.

Sturnira ludovici ludovici Anthony.—Specimens are as follows: one male from a clearing in wet oak-pine forest at La Joya, Veracruz, 6600 ft.; one female taken in a narrow, rock-walled canyon in tropical broadleaf forest 2 mi. W Tamazunchale, San Luis Potosí, 600 ft.; and one female from a narrow canyon in tropical deciduous forest 3 mi. W El Carrizo, Tamaulipas, 1500 ft.

Those examples from La Joya and Tamazunchale were the only bats obtained in mist-netting operations; *Desmodus rotundus* and *Sturnira lilium* were taken the same evening with *S. ludovici* at El Carrizo. To my knowledge El Carrizo is the northernmost known locality of occurrence in eastern México for *ludovici*; the other two records supplement the scanty information on distribution of *ludovici* in San Luis Potosí (Dalquest, 1953) and Veracruz (Hall and Dalquest, 1963).

Myotis keenii auriculus Baker and Stains.—One specimen taken in a mist net set along a trail through dense thorn forest at Ranchero Guayabos, Tamaulipas, 1500 ft., provides an additional record of this little known race. As understood by Findley (1960), *auriculus* was known by four specimens from three localities in eastern México.

Thomomys umbrinus subsp.—Six specimens, three males and three females, are from Rancho Ocotal Colorado (S Aquixtla), 8800 ft. All were taken in a meadow (heavily grazed by horses, sheep, and goats) adjoining fallow fields and sections of dry pine-oak forest. Several *Cratogeomys* were taken in the same clearing, some no more than 15 yards from the *umbrinus* burrows. Three *umbrinus* were captured by excavating their entire burrow system. There were no tunnels connecting the smaller *umbrinus* passageways with larger

burrows, presumably formed by *Cratogeomys,* several feet away. Meadows in fir and pine forest located several miles east of, and over 1000 feet higher than, Rancho Ocotal Colorado were studded with gopher mounds. Tunnels in those I excavated were narrow, being large enough to accomodate only gophers the size of *Thomomys.*

Apparently specimens of *Thomomys* have not been taken from the highlands of northern Puebla. There are populations of *umbrinus* to the northwest in Hidalgo (Sierra de Pachuca, Real del Monte, and Tulancingo), to the southeast in Puebla (San Martin Texmelucan), and to the southwest (Mount Orizaba) of Rancho Ocotal Colorado. These are known by the names *albigularis, martinensis,* and *orizabae,* respectively (Nelson and Goldman, 1934). Geographically, the specimens from Rancho Ocotal Colorado are closer to *albigularis* and *martinensis.* I have no comparative material of the three forms. Assuming that these named populations are distinguishable, my sample from northern Puebla probably will be referred to one of them when morphological variation in *umbrinus* is better understood.

Cratogeomys merriami subsp.—Twelve specimens were obtained in the highlands of northern Puebla; two males and two females from a fallow field adjoining mixed oak, pine, and fir forest at Crus Alta, 9000 ft.; one male and seven females from both a grazed meadow with the *Thomomys* mentioned above and from fields planted to corn, potatoes, carrots, and sugar beets at Rancho Ocotal Colorado, 8800 ft.

Previously, *Cratogeomys* was not known to occur in the highlands of northern Puebla. Populations of *C. irolonis* are found at lower elevations to the west; *C. fulvescens* and *C. perotensis* occur to the east of Crus Alta and Rancho Ocotal Colorado (Hall and Kelson, 1959:469). Lacking adequate comparative material of these forms, I am tentatively referring the series from northern Puebla to *merriami.* They agree well enough with Merriam's (1895*a*:152) description of that species.

Reithrodontomys mexicanus mexicanus Saussure.—An old adult female obtained at the base of vegetated road fill talus in wet oak and conifer forest near Cerro Pelon, 9200 ft., adds to the scanty distributional information of the species in the highlands of Oaxaca. Position of boulders in the road fill provides large moss-lined interstices. Well-worn runways entering these spaces and skirting the base of the fill indicate frequent use of the area by small mammals. Two types of fruit-bearing bushes and a variety of herbaceous plants form a relatively dense understory which continues from the forest floor onto the fill. On previous nights, *Peromyscus lepturus* and *Oryzomys alfaroi*

were trapped in the same spot as *R. mexicanus*. *Reithrodontomys microdon* was taken above the road in similar habitat.

Reithrodontomys microdon albilabris Merriam.—Two males, an adult and subadult, taken in wet oak and conifer forest on the slopes of Cerro Pelon, Oaxaca, 9200 ft. Both examples were trapped alongside rotting logs where leaf litter was absent from the damp forest floor. Nearby, low clumps of shrubs and forbs form a relatively dense ground cover.

Data from these specimens supplement previous information on occurrence and morphology which was based on the only available specimen of the race (Hooper, 1952). The two Oaxacan examples differ from specimens of *microdon* and *wagneri* much as Hooper indicated (*op. cit.*:170). Size differences between representatives of those races and *albilabris* are especially marked in adults of comparable age. *R. m. albilabris* is larger in most external dimensions, but has smaller ears than do specimens of *microdon* and *wagneri*; the skull is larger, the cranium markedly more inflated. Selected external and cranial measurements of the adult *albilabris* follow (taken as explained by Hooper, *op. cit.*:9): total length, 204; tail length, 122; hind foot length, 22; length of ear, 17; skull length, 23.2; zygomatic breadth, 11.9; breadth of brain case, 11.7; depth of cranium, 9.1; interorbital breadth, 3.9; length of molar tooth row, 3.2.

Peromyscus aztecus (Saussure).—Eleven specimens from a wet oak and pine forest 13 mi. NE Metepec (near village of El Potrero), Hidalgo, 6600 ft. Examples were taken from the following situations: a disturbed area between forest border and road fill, this densely covered with tall clumps of shrubs, berry bushes, forbs, and grasses; matted leaves and humus covering the forest floor; and runways alongside rotting logs and between roots of stumps in both the forest interior and along the heavily vegetated area between forest and road. *P. boylei levipes* and *P. aztecus* are sympatric here; examples of both species were taken in similar habitat from the same trap line. The terminal 10–30 mm of the tail in ten of eleven *aztecus* is white; dorsal surfaces of the hind feet in all are streaked with dark brown which extends well beyond the tarsi (almost to the base of toes in some examples). In the five examples of *levipes*, tails do not have white tips, and dark brown markings on the feet extend only slightly beyond the tarsi. This combination of external features distinguishes the two species at this locality.

Peromyscus evides Osgood.—Three specimens from southern Oaxaca; one taken from a sparsely vegetated stream bank adjoining pine-oak

forest near Campemento Río Molino, 7300 ft.; and two trapped on moss-covered rock ledges of a ravine adjacent to groves of coffee 4 mi. S Jalatengo, 5000 ft.

The specimens are from an area between Juquila, type locality of *P. evides,* and San Bartolo Yautepec, type locality of *P. hylocetes yautepecensis* (Goodwin, 1955). All these areas are part of the same topographic unit—the highland mass in extreme southern Oaxaca. My series fits Osgood's (1909;153) description of *evides.* Furthermore, their external and cranial features fall within the range of variation in samples of *evides* from Omilteme, Guerrero, and localities in Michoacán. One *P. boylei levipes* was taken in the same trap line with *evides* at Campemento Río Molino. Thus, the two species are sympatric here in addition to elsewhere in western México (Hooper, 1961:121).

Peromyscus furvus Allen and Chapman.—Specimens are as follows: 30 from 13 mi. NE Metepec (near village of El Potrero), Hidalgo, 6600 ft., and 4 from 2 mi. SE Huayacocotla, Veracruz, 6500 ft. The examples from Hidalgo were trapped under and alongside rotting logs, in crevices along the base of a road fill, and under exposed roots of stumps and trees. Wet broadleaf trees, predominantly bromeliad-covered oaks, and scattered pines form the forest cover; between the road and forest boundary, shrubbery, ferns, and herbaceous vegetation form a dense ground cover. Much of the forest floor was covered with wet oak leaves; ferns were abundant along small watercourses and seeps from the base of rock outcrops. Those mice from Huayacocotla were trapped under logs in a cut over oak and pine forest; berry bushes, forbs, and grasses provide a dense ground cover. At El Potrero, *Peromyscus aztecus, P. boylei, Oryzomys alfaroi,* and *Reithrodontomys sumichrasti* were obtained in the same situations; examples of *Microtus quasiater* were taken in runways through herbaceous vegetation covering nearby slopes.

Geographically, the samples from El Potrero and Huayacocotla are referable to *Peromyscus angustirostris* Hall and Alvarez (1961). Those two localities lie approximately nine miles (airline) to the southeast and northwest, respectively, of Zacualpan, the type locality of *angustirostris.* Morphologically, my samples also agree with that form, but apparently they, along with *angustirostris,* do not differ in any important aspects from *P. furvus.* Besides those samples from El Potrero and Huayacocotla, I have nine paratypes of *angustirostris* from the vicinity of Zacualpan, Veracruz; three examples of *furvus* from

near Jalapa, Veracruz; and 21 specimens of *furvus* from Honey and Huauchinango (1–7 mi. SW), Puebla.

The key characteristics ascribed to *angustirostris* (*op. cit.*:205), i.e., tail that averages longer than head and body, convex longitudinal dorsal outline of skull (from the anterior part of brain case through the interorbital region), and prominent secondary primary fold of M^3, are duplicated in many examples of *furvus* from Jalapa and Huauchinango. Percentages of individuals with tail longer than length of head and body in samples from the five localities follow (number of specimens are in parentheses): Huayacocotla (4), 25 per cent; Zacualpan (9), 89; El Potrero (28), 64; Huauchinango and Honey (21), 71; and Jalapa (3), 67. In the same number of specimens and sequence of localities, percentages of examples which have convex dorsal outlines of the skull are: 11, 44, 39, 49, and 67 per cent. Finally, the prominence of the secondary primary fold of M^3 is variable. In extremely worn teeth it may be almost absent; in unworn teeth it grades from being conspicuous to almost absent. All variants are found in each of the samples, including that series of *angustirostris*.

I do not appreciate the other features ascribed to *angustirostris*, features which are claimed to be diagnostic or to distinguish that form from *furvus* (*op. cit.*:204). Variation in shape of the nasals and size of auditory bullae in *angustirostris* broadly overlaps the range of variation in the sample of *furvus* from Jalapa and Huauchinango. For example, 18 specimens of *furvus* match those from Zacualpan in size of bullae, only six have smaller bullae. Dental characteristics other than those mentioned above, and ascribed to *angustirostris* (*loc. cit.*), namely, depth of internal terminus of first primary fold, prominent mesostyle and slightly developed cingulum in M^1, and the enumerated topographic details of M^2, M^3, M_1, and M_2 also characterize many specimens of *furvus*. Here the differences in dental topography can be correlated with individual and age variation, but not with geographic variation, at least in the specimens at hand. Dry-season pelage in those examples from Zacualpan (taken in April) is slightly paler than are pelages of specimens obtained in wet season from other localities, but is indistinguishable from dry-season pelages of *furvus* from Puebla (taken in February). Finally, the glans penis of *angustirostris* is indistinguishable from that of *furvus* (Hooper and Musser, 1964:5).

Externally, cranially, phallically, and ecologically, the specimens from Jalapa, Huauchinango, Honey, El Potrero, Zacualpan, and Huayacocotla are closely similar; they are clearly part of the same

interbreeding population. Morphological variation within that population appears to be correlated with individual, age, and probably seasonal differences. The available name is *furvus*; I consider *angustirostris* synonymous with *furvus*. If there is any geographic variation that warrants subspecific recognition, it is not evident in the material at hand. I have not examined specimens of *P. latirostris*, the form other than *furvus* considered closely related to *angustirostris* (*ibid.*: 205).

Peromyscus megalops megalops Merriam.—Twenty-nine specimens from the mountains of southern Oaxaca near Campemento Río Molino, 7300 ft. All were taken on steep, high banks of a stream which courses through a canyon forested with oak and pine. The mice were trapped in wide runways under moss-covered logs and along the base of a moss-encrusted, water-dripping rock outcrop immediately above the stream. A deep layer of wet humus and leaf litter covers the stream banks; large ferns, dense shrubby thickets, and forbs comprise the ground cover. Higher on the slopes it is drier; pine and oak predominate and the understory is meager. *P. megalops* was taken only in the more moist situations, examples of *P. evides* and *P. boylei* were obtained in slightly drier areas.

Geographically, the sample is referable to *megalops*; features of skin and skull agree with Osgood's (1909:213) description of that form. Judging from my series and a sample of *auritus* (taken in July from Omilteme and Puerto Chico, Guerrero), morphological differences separating the two races are not impressive. The most distinguishing features appear to be: darker upperparts, particularly the richer tawny along the sides, in *megalops*; tawny, triangular pectoral and axillary regions in *megalops*, the tawny extending onto the belly in some examples (in 47 adult and subadult *auritus*, the pectoral region is tawny but diluted in 3 specimens; absent or narrowly confined to the axillary regions in the remainder); smaller ears (means and extremes of 18 *megalops* and 27 *auritus* are: 22, 20–23; and 23, 22–25, respectively); and slightly smaller auditory bullae in *megalops*.

Peromyscus megalops melanurus Osgood.—Six examples from 4 mi. S Jalatengo, Oaxaca, 5000 ft., provide an addition to the scanty distributional information of the race. Examples were taken under stumps, rotting logs, or along the bases of rock outcrops near the damp, humid bottom of a steep ravine. Shrubs and weeds covered the slopes; most of the trees had been cut out. *P. evides* was taken in slightly more exposed situations higher on the slopes of the ravine.

The series is clearly referable to *melanurus*. However, the color

of their underparts is dissimilar to that described for the race (Osgood, 1909:215). In all six specimens the hairs are black basally, white distally; the overall effect is white rather than yellowish white as in Osgood's series—a difference possibly related to season (wet-season August pelage versus dry-season March pelage).

Peromyscus thomasi.—Fifteen adult specimens, eight males and seven females, were trapped in a wet, cool oak and conifer forest in the highlands west of Chilpancingo near Puerto Chico, Guerrero, 8400 ft.

Specimens were obtained from the following situations: two from a runway encircling the base of an oak tree; two from moist, protected rock ledges; two from runways on slopes densely covered with a variety of shrubs and berry bushes; and the remainder from well-formed runways in leaf litter and humus under piles of tangled rotting logs and brush on the forest floor. Thirty-four *P. megalops* and six *P. boylei* were taken throughout these same situations; one *Neotoma mexicana* was trapped in a runway under a log and brush pile from which a *thomasi* had been obtained on the previous night. *P. megalops* was more frequently taken from rock outcrops than from situations where the majority of *thomasi* were obtained. Traps set in well-defined runways through wet moss covering the rock ledges yielded only *megalops* or *boylei*, never *thomasi*. These trapping records indicate that *thomasi* is terrestrial; it is generally an inhabitant of the forest floor. Here it uses runways through leaf litter and humus, runways protected by some type of larger ground cover; specimens of *thomasi* were trapped less frequently in rock outcrops.

Heretofore, Mexican populations of the subgenus *Megadontomys* were known only from Guerrero (*P. thomasi*) and Veracruz (*P. nelsoni*; see Osgood, 1909). We obtained several specimens of a large, dark *Peromyscus* in the high, cold, wet cloud forest near Cerro Pelon, Oaxaca. Morphologically and ecologically this sample represents a population of *Megadontomys* distinct from, but allied to, *thomasi* and *nelsoni*. It is described below.

Peromyscus thomasi cryophilus, new subspecies

(Fig. 1; Table 1)

HOLOTYPE.—Adult male, skin, skeleton, and glans penis; Univ. Mich. Mus. Zool. No. 112872; México, Oaxaca, Distrito de Ixtlán, Sierra de Juárez, 13 mi. (on Tuxtepec-Oaxaca de Juárez road) NE Llano de las Flores on upper slopes of Cerro Pelon, 9200 feet eleva-

TABLE 1

EXTERNAL AND CRANIAL MEASUREMENTS (MEANS AND EXTREMES OF ADULTS; MM) OF THREE SUBSPECIES OF *Peromyscus thomasi*

Subspecies	No.	External, lengths				Weight (grams)	Cranial						
		Total	Tail vertebrae	Hind foot	Ear from notch (flesh)		Greatest length	Breadth of rostrum	Length of nasals	Breadth across zygomatic arches	Breadth of interorbital area	Length of palate	Alveolar length of upper molar row
cryophilus	5	320	170	32	22	84.5	36.6	6.3	14.7	18.8	5.5	6.1	6.4
		300–331	155–185	31–33	21–22	72.7–93.2	35.8–37.5	6.0–6.7	14.3–15.3	18.3–19.6	5.3–5.8	5.9–6.2	6.2–6.5
thomasi	15	316	167	32	27	77.0[a]	36.0	6.1	13.9	17.9	5.4	6.0	6.2
		295–351	150–185	31–34	25–28	61.5–112.8	34.7–37.6	5.8–6.5	13.5–15.1	17.0–19.9	5.2–5.7	5.6–6.3	6.0–6.6
nelsoni	1	318	170	32	21[b]	....	36.5	6.1	13.4	18.2[c]	5.3	6.1	6.7

[a] Based on 14 specimens.

[b] Measured dry.

[c] Estimated (posterolateral segment of left arch missing).

tion; one of 9 specimens collected 8 August 1963 by Guy G. Musser; original No. 2828.

RANGE.—Known only from the type locality.

CHARACTERS AND COMPARISONS.—A race of *Peromyscus thomasi* characterized by dark coloration, heavy body, small ears, wide rostrum, long nasals, widely flaring zygomatic region, peculiarities of the zygomatic plate, small bullae, and distinctive features of the glans penis.

Compared with 15 topotypes of *thomasi* from Puerto Chico, Guerrero, of comparable pelage and age: similar in proportions and size; tail slightly longer, ears smaller in all dimensions, and weight greater. Upperparts darker owing to overall greater admixture of black-tipped hairs and dilution of ochraceous along sides of body (hairs along sides tipped with Light Ochraceous-Buff instead of the richer, deep Ochraceous-Tawny in *thomasi*), with little or no differentiation of dorsum from sides (in strong contrast to the tawny sides and blackish dorsum of *thomasi*); dusky areas around eyes and at base of vibrissae more extensive; cheeks darker (fewer whitish-tipped hairs); underparts darker as a result of greater admixture of slaty undercolor, especially in the throat region. Pilosity of hind feet reduced, the hairs shorter, fewer in number, and more silver than white; overall effect is a darker, grizzled dorsal surface of foot rather than being white (in 13 of 15 *thomasi,* dusky brown of shank terminates abruptly just beyond ankle; remainder of feet are whitish in contrast to all examples of *cryophilus* and two of *thomasi* which have darker, grizzled dorsal surfaces of feet that gradually darken proximally beyond the ankle). Rostrum and zygomatic region slightly wider; nasals and upper molar tooth rows longer; differentiation of supraorbital margins of frontals variable (seven examples of *cryophilus* and four *thomasi* have margins elevated but not prominently ridged or "beaded," two *cryophilus* and eleven *thomasi* have conspicuously ridged margins); zygomatic notch deeper and anterior edge of zygomatic plate convexly curved (straight or slightly concave in *thomasi*); posterior margins of palate usually broadly concave (in *thomasi,* two specimens concave, 14 truncate or with slight median projection); brain case slightly less inflated and auditory bullae average smaller. Glans penis similar in size and configuration (see Hooper and Musser, 1964:6, for description of glans in *thomasi*); basal one-half more bulbous, distal one-half more constricted, evenly tapered to an acute, dorsally bent tip; spines about twice as large, both in absolute length and basal diameter; baculum

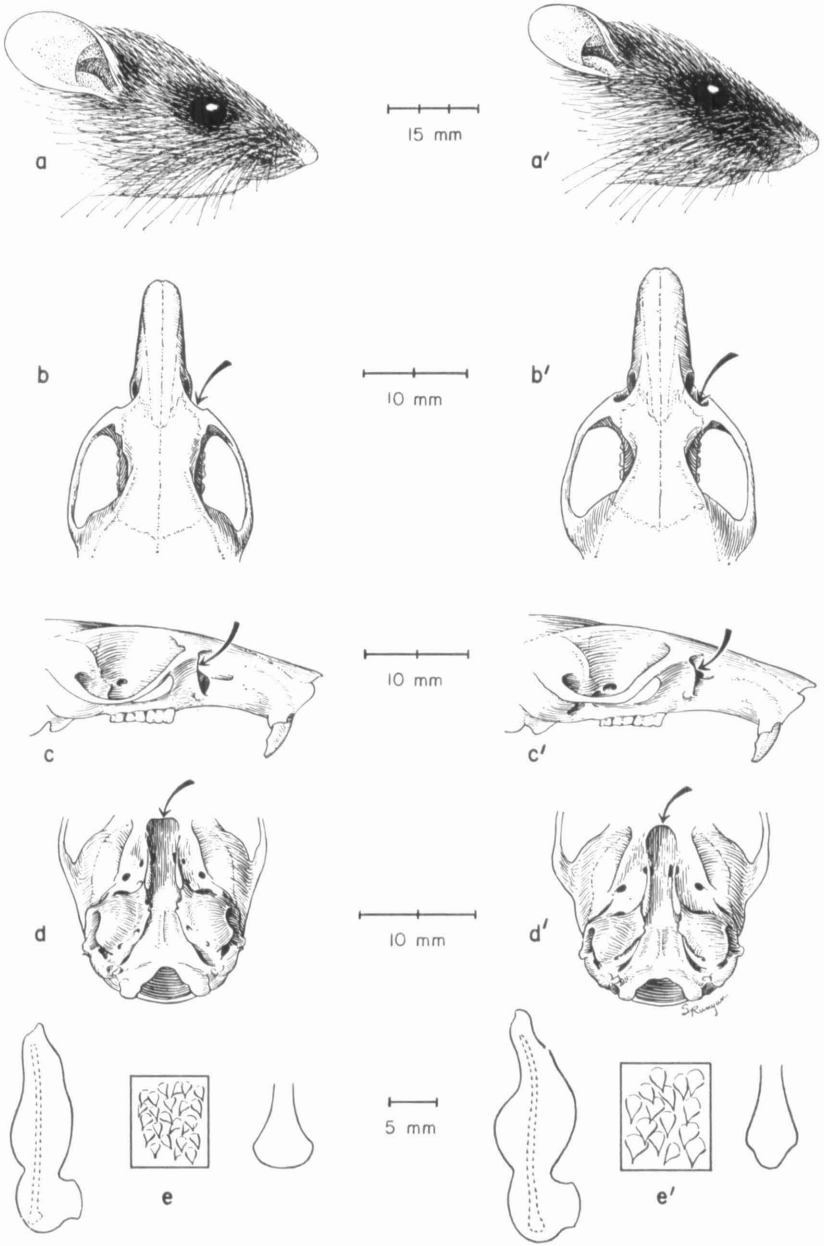

FIG. 1. Some external, cranial, and phallic (spines and base of baculum enlarged to same scale) features of two subspecies of *Peromyscus thomasi*: a–e, *thomasi* (UMMZ 112886), Guerrero; á–é, *cryophilus* (UMMZ 112872), Oaxaca. See text for explanations.

arched dorsad instead of erect, its base (in ventral view) diamond-shaped instead of truncate proximally.

Compared with the paratype of *P. nelsoni* and notes of W. H. Burt, who kindly examined the type specimen of *nelsoni* for me: *cryophilus* resembles *nelsoni* in the darker hind feet, dimensions of ear, ridging of supraorbital margins of frontals, and depth of zygomatic notch; in other features (except glans penis which is unknown in *nelsoni*) it differs from *nelsoni* much as it does from *thomasi.*

REMARKS.—Morphologically, *P. nelsoni,* known by only two specimens (Osgood, 1909:221), has features of both *thomasi* and *cryophilus,* although it may be closer to *thomasi.* Excepting lengths of hind foot and upper molar tooth row, external and cranial measurements of *nelsoni* match individual specimens of both *thomasi* and *cryophilus.* Upperparts are slightly darker than most specimens of *thomasi,* especially the dorsa of the hind feet, but paler than the majority of *cryophilus*; however, as Osgood indicated (*ibid.*), the worn pelage of *nelsoni* is scarcely distinguishable from comparable pelage in *thomasi.* Supraorbital margins of the frontals of *nelsoni* are elevated, like many examples of *cryophilus,* but not prominently ridged as in most specimens of *thomasi.* Depth of zygomatic notch is between *thomasi* and *cryophilus,* but projecting anterior edge of zygomatic plate is straight, not curved; other cranial features as in *thomasi.*

More specimens of *nelsoni* are needed to determine the extent of morphological variation in that population; fresh specimens would be especially desirable to evaluate color characteristics. The close relationship of *nelsoni* to *thomasi,* however, is evident even with the two examples of *nelsoni* available for study. The supraorbital ridging in *thomasi,* the primary feature used to distinguish that form from *nelsoni* (Osgood, *ibid.*) is not well expressed in all examples—some have slightly lower elevated margins as in the paratype of *nelsoni.* In several features of skin and skull *nelsoni* bridges the morphological gap between *thomasi* and *cryophilus*; particular cranial features and coloration indicate that it may be morphologically closer to *thomasi,* but study of more adequate material, especially of the glans penis, may demonstrate closer affinities with *cryophilus.*

My interpretation of present data is that the three populations, one from the highlands of Guerrero (*thomasi*), one from Veracruz (*nelsoni*) and *cryophilus* are part of the same specific unit. All three forms are similar in morphology and habitat, and each appears to be ecologically restricted. My trapping records for specimens of *thomasi* and *cryophilus* indicate that they are restricted to high, cold, very wet

forests of predominantly oak, with some pine and fir. Although I have not trapped *nelsoni,* Goldman's (1951:272–4) description of the area from which that form was obtained indicates it too is an inhabitant of cool, wet oak and conifer forest.

Each of the three populations is now separated from the others by intervening areas of apparently inhospitable terrain. But the morphological differences between them are average, and are of no more than subspecific value. The total available evidence suggests that the three populations are differentiated geographic races of one morphologically and ecologically coherent species. The degree of differentiation between them is unequal—*thomasi* and *cryophilus* represent the extremes; *nelsoni* falls somewhere between those two. These three races of *P. thomasi* can be listed formally in the subgenus *Megadontomys* as follows:

Peromyscus thomasi thomasi Merriam: type locality, mountains near Chilpancingo, Guerrero, México.

Peromyscus thomasi nelsoni Merriam: Type locality, above Jico, Veracruz, México.

Peromyscus thomasi cryophilus Musser: type locality, Cerro Pelon, Sierra de Juárez, Oaxaca, México.

This arrangement slightly modifies an earlier listing of the forms in *Megadontomys* (Hooper and Musser, 1964:13), but it does not alter the conclusion that *thomasi* is morphologically and probably phyletically peripheral to the main cluster of species in *Peromyscus.*

All nine specimens of *cryophilus,* five adults and four subadults, were taken in cold, wet oak and conifer forest; one from the moss-lined interstices in a road fill, the remainder from deep, well-formed runways in the wet, deep layer of leaf litter and humus under rotting log piles. Like *thomasi, cryophilus* is apparently terrestrial. Dense herbaceous vegetation and clumps of shrubs make up the ground cover between oak trees and log piles. Bushes heavy with blackberry-like fruit and some with currant-like berries were common in a cut-over area between the forest boundary and a roadbed. The stomachs in most specimens of *cryophilus* were distended with a red, pulpy mash and some green material; evidently the berries, when in season, form a large part of the diet of these mice.

My trapping records indicate that *cryophilus* and *P. lepturus* occur together in the same habitat. Both species were taken in closely adjacent traps; and individuals of both kinds were often obtained from the same trap site in a runway on different nights. *P. lepturus*

was the more common species (600 trap nights yielded 9 *cryophilus* and 24 *lepturus*).

Neotoma goldmani Merriam.—Two adult specimens, male and female, were taken in the desert of southwestern Nuevo León approximately 12 mi. N Matehuala, 5900 ft. Both examples were trapped on the rocky sides of a shallow ravine where the rock ledges were almost hidden by the desert shrubs and cacti. *Perognathus nelsoni* and *Peromyscus pectoralis* were taken in similar habitat nearby.

Oryzomys alfaroi caudatus Merriam.—Specimens are from the cold, wet oak and conifer forests of the Sierra de Juárez, Oaxaca, as follows: three from runways under exposed moss-covered roots of pine stumps 4 mi. SW Llano de las Flores, 8700 ft.; three taken under rotting, moss-covered logs, providing foundations for a roadbed N Llano de las Flores, 9500 ft.; and 15 from near Cerro Pelon, 9200 ft., where they were obtained from runways alongside and under rotting logs overgrown with fruit-bearing bushes. *Peromyscus lepturus,* taken in the same habitat along with *alfaroi,* was common at all three localities.

The variation in external and cranial morphology among specimens of comparable age in the Oaxacan series of *alfaroi* is impressive. On the average, the sample is comprised of mice with dark upperparts and large, robust skulls. Dimensions of the largest specimen agree with those given for the type of *caudatus* (Goldman, 1918:65), but smaller individuals in the series match specimens of comparable age of *dilutior* from Puebla, Hidalgo, and Veracruz, and *angusticeps* from Chiapas. Color of the Oaxacan examples is more like *dilutior*; some are inseparable from that form, but most specimens are slightly darker dorsally. External and cranial measurements, listed below, approximate those given for other named populations of *alfaroi,* e.g., *angusticeps, rhabdops, caudatus* (Goldman, *op. cit.*), and *gloriaensis* (Goodwin, 1956:9). Means and extremes of selected external and cranial measurements (explained by Goldman, 1918:10) from 9 adults follow: total length, 231, 222–245; tail length, 120, 112–130; length of hind foot, 26, 25–28; ear from notch (in flesh), 16, 14–19; greatest length of skull, 27.7, 26.3–28.5; zygomatic breadth, 14.1, 13.5–14.5; interorbital breadth, 4.7, 4.5–4.9; width of brain case, 10.7, 10.5–11.3; length of nasals, 10.8, 10.4–11.6; length of upper molar teeth, 3.9, 3.6–4.1.

Geographically, the Oaxacan sample is from the same highland complex in central Oaxaca as the two specimens of *caudatus* (Goldman, *op. cit.*: 64–5), although they were taken farther west and from higher elevations. It is primarily on the basis of geography that they

are here tentatively referred to *caudatus*. The paucity of information regarding the biology of *alfaroi*, at least of those populations in southern México, indicates that the species is in need of a systematic review. There appear to be too many names based on too few specimens; a condition that may, or may not, represent the actual picture of diversification in the species.

Microtus mexicanus fulviventer Merriam.—Specimens are from the highlands in Oaxaca as follows: Near Campemento Río Molino, 7300 ft., 2; Cerro San Felipe, 10,000 ft., 5; 4 mi. SW Llano de las Flores, 8700 ft., 2; N Llano de las Flores, 9500 ft., 17; near Cerro Pelon, 9200 ft., 12. Those from Río Molino were taken in runways through cut-over streamside vegetation; oak and pine covers the drier slopes above the streambed. All remaining examples were obtained from wet, cool, oak and conifer forest. Abundant at both Llano de las Flores and Cerro Pelon, they were commonly found in runways alongside rotting, moss-covered logs, around the bases of rock outcrops, through thick wet moss on rock ledges, and in the narrow ecotone between forest and llano.

Apparently *fulviventer* is the southern morphological and ecological counterpart of *M. mexicanus*. I have compared the sample of *fulviventer* with examples of the following named variants of *mexicanus*: *fundatus, mexicanus, mogollonensis, neveriae, salvus, subsimus,* and *phaeus*. Distinguishing features ascribed to *fulviventer* (Merriam 1898:106; Bailey 1900:55–6) are average, not absolute; they are of the kind that distinguish other races of *mexicanus* from one another. For example, the "characteristic" reddish upperparts and fulvous underparts of *fulviventer* (Merriam, *loc. cit.*) are also typical of *salvus, fundatus,* and *neveriae*; the fulvous underparts also occur sporadically in specimens of *mexicanus* and *phaeus*. I fail to appreciate most of the distinguishing cranial and dental features of *fulviventer* listed by Bailey (*op. cit.*: 56). As he indicated, the molars in *fulviventer* are relatively somewhat larger than in *mexicanus*, but the difference is slight. The most diagnostic feature may be the small auditory bullae in *fulviventer*. This character separates most but not all examples from *mexicanus*. Compared with other populations, such as *neveriae*, the size differences in the bullae are slight or nonexistent. The glans penis in *fulviventer* is closely similar to that in *mexicanus* (Hooper and Hart, 1962). To my knowledge, there are no specimens from intervening geographic areas between *mexicanus* and *fulviventer*, thus, no evidence of interbreeding; however, the two series intergrade

by individual variation. Total evidence at hand indicates that the population represented by *fulviventer* is a differentiated, geographic race of a variable species, *mexicanus*.

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