A Taxonomic and Distributional Study of the Western Subspecies of the Milk Snake, Lampropeltis doliata

WILMER W. TANNER[1] and RICHARD B. LOOMIS[2]

Introduction

More than thirty years have passed since Blanchard (1921) assigned the milk snakes of the Great Plains west to the Great Basin to a single subspecies, *Lampropeltis triangulum gentilis* (Baird and Girard). He outlined the geographic range of this subspecies, using forty-five specimens, as southern South Dakota, south through the western two thirds of the states of Nebraska, Kansas, Oklahoma and Texas, west from central Texas through New Mexico, eastern Colorado, Utah, and into southeastern Arizona.

Additional collecting has shown that the range of *gentilis* should be extended into eastern Wyoming, western South Dakota, southern Montana, western Colorado, northern Arizona, and into Utah to a greater extent than had previously been known. Specimens from central Texas have been placed with the subspecies *L. doliata annulata* Kennicott.

The specific name of *triangulum* was replaced by *doliata* (Klauber, 1948). However, in recent studies of this problem, Mittleman (1952) and Smith (1952) have presented data showing that the type of *doliata* was in all probability a specimen of *Cemophora* and that the change in nomenclature as suggested by Klauber is unwarranted. An examination of the available data suggests a need for additional specimens from the Carolinas, and until such material is available it would seem undesirable to introduce another change at this time. We are, therefore, retaining *doliata* as the specific name. This conforms also with the usage by Schmidt (1953).

Examination of the available specimens referred to *gentilis,* including the types of *Ophibolus gentilis* Baird and Girard, *Lampropeltis multistrata* Kennicott, and *L. pyrrhomelaena celaenops* Stejneger, as well as an examination of specimens of the subspecies *annulata, amaura,* and *syspila,* has convinced us that *gentilis,* as previously recognized and described by Blanchard (*op. cit.*), should be divided into four separate subspecies. Names are available for three of these geographic races (*gentilis, multistrata* and *celaenops*) while the fourth, a new subspecies, is described below.

Transactions of the Kansas Academy of Science, Vol. 60, No. 1, 1957.

[1]Department of Zoology and Entomology, Brigham Young University, Provo, Utah.

[2]Department of Biology, Long Beach State College, Long Beach, California.

Acknowledgments

Because of the seeming rarity of the secretive and nocturnal western subspecies of *Lampropeltis doliata,* it has been necessary to borrow all available specimens. This would have been impossible without the generous loans of specimens by the following individuals, either from their private collections or from collections under their care. For this courtesy we extend our sincere thanks. The abbreviations in parentheses are used throughout the paper to designate the collection.

Dr. Edward H. Taylor, University of Kansas Museum of Natural History (UK).

Dr. Hobart M. Smith, University of Illinois Museum of Natural History (UI).

Dr. A. M. Woodbury, University of Utah (UU).

Dr. C. Bertrand Schultz, Director, University of Nebraska State Museum (NSM).

Dr. William J. Koster, personal collection (WJK), now in the collection of the University of New Mexico.

Mr. Arthur Loveridge, Museum of Comparative Zoology, Harvard (MCZ).

Dr. Norman Hartweg and Dr. James Peters, University of Michigan Museum of Zoology (UMMZ).

Dr. Doris M. Cochran, United States National Museum (USNM).

Mr. Clifford H. Pope, Chicago Natural History Museum (CNHM).

Dr. I. A. Ortenburger, University of Oklahoma Museum of Zoology (OU).

Mr. Harold A. Dundee, personal collection (HAD), University of Michigan.

Dr. W. Frank Blair, Texas Natural History Collection, The University of Texas, Austin (TNHC).

Dr. Bryan P. Glass, Oklahoma A. & M. College (OAM).

Mr. Lawrence Curtis, personal collection (LC), Fort Worth, Texas.

Dr. Robert C. Stebbins, University of California Museum of Vertebrate Zoology, Berkeley (MVZ).

Dr. George T. Baxter, University of Wyoming (UW).

Dr. T. Paul Maslin, University of Colorado (CU).

Mr. Charles M. Bogert, American Museum of Natural History, New York (AMNH).

Dr. Howard K. Gloyd, Chicago Academy of Sciences, Chicago, Ill. (CAS).

Dr. John Breukelman, Kansas State Teachers College, Emporia (KSE).

Dr. George S. Myers, Stanford Natural History Museum, Calif. (SNHM).

Dr. Lawrence M. Klauber, personal collection (LMK), San Diego, California.

Mr. A. J. Kirn (deceased), personal collection (AJK), Somerset, Texas.

Park Naturalist at Mesa Verde, National Park (MVNP).

Brigham Young University (BYU), Provo, Utah.

Special thanks are extended to Mr. J. Knox Jones, Jr., Universtiy of Kansas, and Mr. Olin L. Webb, Ft. Morgan, Colorado, for obtaining several important specimens in Nebraska. These and other specimens are now in the personal collection of one of us, Loomis (RBL). We also wish to thank Dr. Richard Zweifel now at the American Museum of Natural History, for the loan of his manuscript (then in press in Copeia) on *Lampropeltis zonata,* and the many other individuals who have generously aided the authors in the preparation of this paper.

The senior author is especially grateful to the following for their gifts of specimens and data to Brigham Young University: Merlin Killpack of Roosevelt, Loraine Woodbury of Orem, and Elden Hardy of Lehi, Utah; Mr. Dee Jay Nelson of Billings, Montana; Mr. John E. Werler of the San Antonio Zoological Society; and to Dr. W. A. Thornton, Sam Houston State College, Huntsville, Texas. These specimens came from critical areas and have added much to our study.

Variation in Pattern

The various color patterns of the different subspecies of *Lampropeltis doliata* seemingly arose from a single ancestral pattern. This ancestral pattern is considered by Smith (1942:198) to be close to, if not identical with, the pattern exhibited by *Lampropeltis doliata arcifera* (Werner) of the southern part of the Mexican Plateau. The body pattern of *arcifera* (see fig. 66, Blanchard, 1921:242, listed as *L. t. annulata*) consists of a whitish ground color formed into complete rings or annuli that separate wide black bands or triads which enclose areas of red. Some of the red is restricted to lateral areas whereas other triads possess areas of red extending down to the ventrals and uniting across the dorsum. The head of *arcifera* is predominantly black with the first white (nuchal) annulus rarely extending behind the parietals.

This pattern, as represented by *arcifera,* seems ancestral to that of the subspecies *annulata* of northeastern Mexico and southern Texas and a pattern similar to that of the latter is in turn considered ancestral to the patterns of the nine subspecies of *L. doliata* which occur in the United States. In *annulata,* the triads are few and each has a dorsolateral red

saddle with the ventral part of the triad being black. Also, the head is predominantly black.

To the north and east of *annulata* are three subspecies (*amaura, doliata* and *temporalis*) which retain the complete or nearly complete triads, but the red areas have increased in width and frequently extend completely across the ventrals, largely at the expense of the black. The triads have remained wide and few in number. On the head, red and white has replaced part of the black.

North and northwest of the range of *annulata* the subspecies have two principal types of patterns and intermediates between them. One variation consists of reduction in the width of the triads, usually with the greatest reduction in the red, especially on the ventral and lateral scales. In addition, the number of triads have increased and in some subspecies the annuli are wider, principally on the sides, first scale row and edge of ventrals, and middorsally. The head patterns tend to be lighter toward the north, with white usually replacing the black. Four subspecies, including *gentilis* and *celaenops,* exhibit this pattern.

Another variation in pattern occurs in *syspila* and *triangulum* of the northeastern United States. The body triads have been reduced to large dorsal blotches or saddles of red to brown surrounded by a black border which does not extend across the ventrals. In addition, there are small lateral, light-centered black spots which alternate with the large dorsal blotches. These lateral spots appear to have migrated from the ventrals where they originally were part of the ventral pattern of the triad. The head pattern has modified with an increase in the amount of red and a marked decrease in black.

A further discussion of the variation in pattern of *L. doliata* as exhibited by the subspecies found in the United States will be given later under intraspecific affinities.

Accounts of Subspecies

The following scale characters are uniform, unless otherwise noted, for all of the subspecies listed below: Dorsal scale rows smooth, 21-21-19, frequently increased to 23 anteriorly, and from 17 to 21 posteriorly; supralabials 7-7; infralabials 9-9, rarely 8 or 10 on one or both sides except in two subspecies, *nelsoni* where 8-8 is not unusual and *taylori* where 8-8 is common; loreal single, longer than high; one preocular; two postoculars; temporals 1-2 to 2-3; anterior chinshields longer than posterior chinshields, the latter separated by one or more small gular scales; other head scales normal for the species.

Lampropeltis doliata annulata Kennicott
Mexican Milk Snake
Plate 1

Lampropeltis annulata Kennicott, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 329 (type Acad. Nat. Sci. Phila. no. 3613, from Matamoras, Mexico, Lieut. Couch, collector).

Lampropeltis triangulum annulata, Blanchard, U. S. Nat. Mus., Bull. 114: 159, 1921; Taylor, Univ. Kansas Sci. Bull. 26:466, 1940; Schmidt and Owens, Field Mus. Nat. Hist. Zool. Ser., 29:112, 1944; Brown, Baylor Univ. Studies, 1950, p. 165.

Lampropeltis doliata annulata, Klauber, Copeia 1948: 11; Milstead, Mecham and McClintock, Texas Jour. Sci. 2:555, 1950.

Range.—Southern Texas, eastern Coahuila, northern Nuevo León and northern Tamaulipas, Mexico.

Diagnosis.—Snout black; annuli 19 to 26, all complete and not expanded on the first scale row; red areas broad and saddle-shaped, not extending onto belly; black rings not confluent dorsally across red, but fusing ventrally to form large black quadrangles which alternate with the smaller white annuli along the venter; ventrals 187 to 210; scale rows 21–21 or 21–23.

Remarks.—Two specimens (TNHC 1402 and 7134) from western Texas seem to be typical *annulata.* Differences noted were the low number of ventrals (194 and 187, respectively) and the lighter appearance of the snout. The black bands are only slightly wider middorsally and the triads are nearly all black on the belly. The annuli, 21 and 20 respectively, are normal for *annulata,* but would be fewer than expected for individuals of *gentilis* or *celaenops.*

Lampropeltis doliata from the high plateaus of central Mexico listed by Blanchard, (1921, fig. 66) have been placed in the subspecies *arcifera* by Smith (1942), thereby restricting *annulata* to northeastern Mexico.

Specimens examined.—Total 15, as follows: TEXAS. *Bexar Co.:* San Antonio (USNM 7116). *Brazos Co.:* Bryan (BYU 13081). *Cameron Co.:* (USNM 17031-2); Brownsville (UK 18509; CNHM 38045; USNM 1841, 1855). *Jeff Davis Co.:* Fort Davis (TNHC 1402). *LaSalle Co.:* 16 mi. S Cotulla (UMMZ 75611). *Medina Co.:* 5 mi. N San Geronimo (AJK 2380). *Reagon Co.:* Texon (TNHC 7134).

MEXICO. *Tamaulipas:* Matamoras (USNM 1857). *Nuevo León:* Montemorelos (USNM 37535); Monterrey (USNM 1845).

Additional records.—TEXAS (Brown, 1950:164, unless otherwise noted). *Cameron Co.:* 10 mi. NW Pt. Isabel; 14 mi. NW Pt. Isabel.

Kerr Co.: Kerrville; 16 mi. S Kerrville. *Starr Co.:* 5 mi. SW Ramirito. *Terrell Co.:* Stockton Plateau, (Milstead *et. al.*; 1950.)*

MEXICO. *Coahuila:* Paso de Los Tablos, Sabinas River near Muzquiz (Schmidt and Owens, 1944). *Nuevo León:* Mamulique Pass (Taylor, 1940).

Lampropeltis doliata amaura Cope
Louisiana Milk Snake
Plate 1

Lampropeltis amaura Cope, Proc. Acad. Nat. Sci. Philadelphia, 1860 p. 258 (type USNM no. 5282, type locality "unknown," original entry of type reads "?Mississippi," but designated by Schmidt, 1953:209, as vicinity of New Orleans, Louisiana.)

Lampropeltis triangulum amaura, Blanchard, U. S. Nat. Mus., Bull. 114:172, 1921; Brown, Baylor Univ. Studies, pp. 164–165, 1950.

Lampropeltis doliata amaura, Klauber, Copeia, 1948.

Range.—Eastern Texas, southeastern Oklahoma, southern Arkansas, Louisiana, except the Florida Parishes, and Western Mississippi. Restricted almost entirely to the Gulf coastal plain west of the Mississippi River.

Diagnosis.—Snout red, occasionally mottled with black, rest of head usually black; annuli 19 to 27; black of triads narrow, interrupted ventrally, black not pronounced on belly; annuli greatly expanded laterally and ventrally; ventrals 180 to 205; scale rows usually 21–21, occasionally 19–21 or 21–23.

Remarks.—A specimen (USNM 15551) from Cooke County, Texas, is perhaps *gentilis.* There are 30 annuli, 54 caudals, both more than in *amaura,* and the first triad is only 11½ scales in width middorsally. Geographically it is closer to known specimens of *amaura* both in Oklahoma and in Texas. The first red blotch is seven scales long, a condition found in both *amaura* (7–17) and *gentilis* (2–8). Specimens from Aransas, Calhoun, Matagorda and Walker counties, Texas show an increase in black, both on the ventrals and on the snout, approaching the characters of *annulata,* furthermore they are seemingly larger than the average *amaura.*

Specimens examined.—Total 20, as follows: TEXAS. *Bowie Co.:* 5 mi. W Maud (TNHC 9740). *Dallas Co.:* Dallas (MCZ 2504,2405—two). *Harris Co.: Bellaire* (TNHC 8564). *Harrison Co.:* 12 mi. SW Marshall (CNHM 37560). *Jasper Co.:* 20 mi. E Woodville (AJK 2646). *Lamar Co.:* Paris (USNM 55904). *Leon Co.:* 5 mi. W Marquez (CNHM

*Axtell and Wasserman, 1953, (Herpetologica, 9:1-6) reported an example of *L. doliata* from 1 mi. SE Hebbronville, Jim Hogg Co., which was considered an intergrade between *annulata* x *gentilis* although it was taken within the range of *annulata.* It seemingly represents an extreme in the characters of *annulata.*

41713). Intergrades between *amaura* and *annulata: Aransas Co.*, near Port Aransas (LCA 535). *Calhoun Co.:* Middle part of Matagorda Island (BYU 12718–21). *Matagorda Co.:* SE tip Matagorda Peninsula (BYU

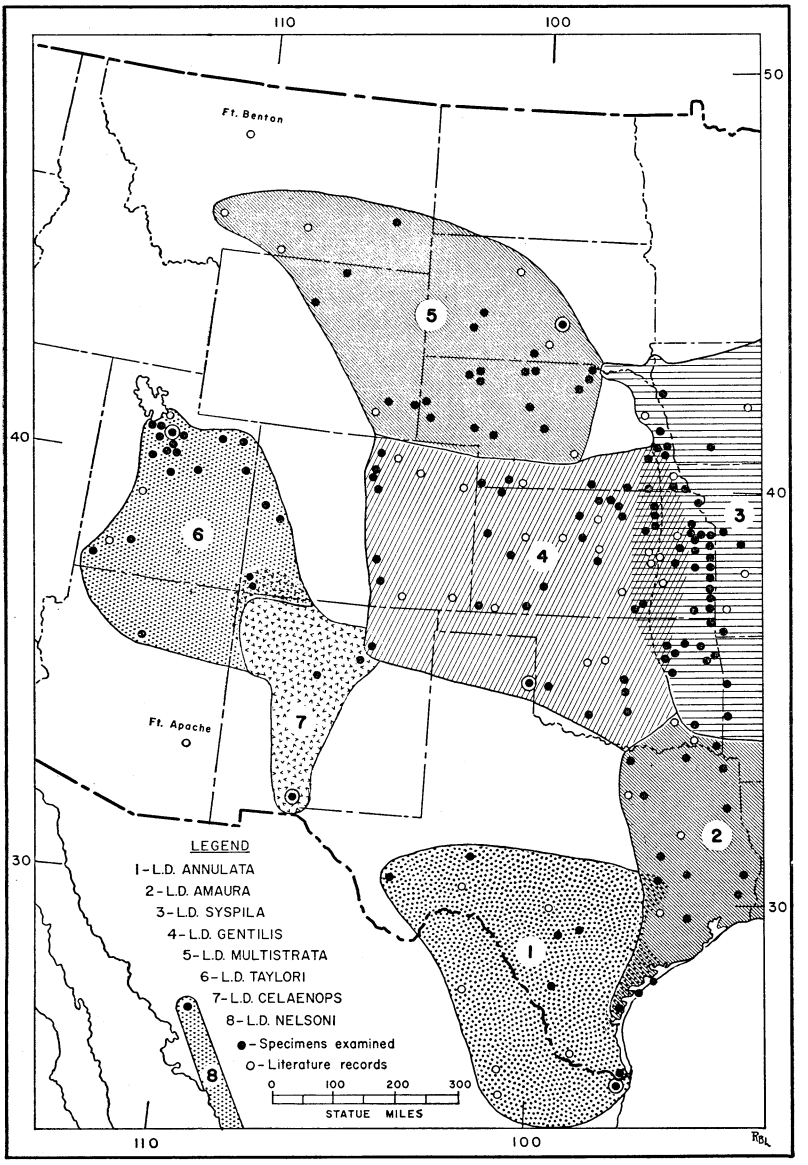

Plate 1. Distribution and locality records of Lampropeltis doliata as it occurs in central and western United States and in northern Mexico.

12722–4). *Walker Co.:* Highway 247 near Bedias Creek (BYU 13079). OKLAHOMA. *McCurtain Co.:* (UO 20187) (UI 1107).

Additional records.—(Brown, 1950:164, unless otherwise noted). TEXAS. *Anderson Co.:* 4 mi. W Palestine. *Austin Co.:* 8 mi. E Sealy. *Galveston Co.:* Galveston. *Hardin Co.:* 8 mi. SW Saratoga. *Harris Co.:* Houston. OKLAHOMA. *Atoka Co.:* Limestone Gap (Blanchard, 1921). *Choctaw Co.:* (*ibid*).

Lampropeltis doliata syspila (Cope)
Red Milk Snake
Plate 1

Ophibolus doliatus syspilus Cope, Proc. U. S. Nat. Mus., 11:384, 1888 (type, USNM no. 13380, from Richland County, Illinois, Robert Ridgway, collector).

Lampropeltis triangulum syspila, Blanchard, U. S. Nat. Mus., Bull. 114:179, 1921; Burt, Amer. Midl. Nat., 16:332, 1935; Breukelman and Smith, Univ. Kansas Publs. Mus. Nat. Hist., 1:109, 1946.

Lampropeltis doliata syspila, Klauber, Copeia, 1948:11; Smith, Univ. Kansas Mus. Nat. Hist., Misc. Publs. 2; p. 249, 1950; Breukelman and Clarke, Trans. Kansas Acad. Sci., 54:544, 1951.

Range.—Southern Indiana and Illinois, western Kentucky and Tennessee, Iowa, Missouri, northern Arkansas, eastern Oklahoma, eastern Kansas, eastern Nebraska and probably southeastern South Dakota.

Diagnosis.—Head with dorsal red spot or spots, surrounded by black, snout usually whitish, mottled with red and black; annuli 21 to 36; dorsal pattern consisting of red saddles or blotches encircled by black; with a second lateral row of smaller black spots or spots with red center; belly usually checkered with black and white, occasionally immaculate; ventrals 180 to 215; caudals 40–54.

Comparisons.—A broad region of intergradation occurs between *gentilis* and *syspila* in east-central Kansas, southeastern Nebraska and northeastern Oklahoma. This is roughly comparable to the region known as the Flint Hills, where the trees along the streams and valleys interdigitate with the grasslands of the hills and uplands. Large areas exist where slabs of limestone rest on the soil or protrude from outcroppings and from beneath these limestone shelters relatively large numbers of king snakes have been taken in the spring. Perhaps they are more common in this region than in any other part of the range of the species. Specimens from this region are usually intermediate, in one or several characters, between *syspila* and *gentilis.*

We did not examine specimens which could be considered as inter-

mediate between *syspila* and *amaura,* although they should occur in southern Arkansas.

Specimens examined.—Total, 109 as follows: ARKANSAS. *Polk Co.:* Rich Mountain (USNM 48187). *Sebastian Co.:* Ft. Smith (SNHM 4344–6). IOWA. *Adams Co.:* 5 mi. N Corning (NSM 839); 7 mi. W Corning (NSM 565). *Woodbury Co.:* Sioux City (UMMZ 52204). ILLINOIS. *Champaign Co.:* (UI 2154); *Fayette Co.*: (UI 1569); *Monroe Co.:* (UI 18583). KANSAS. *Anderson Co.:* (UK 2238, 2245, 2247); 4 mi. N Garnett (UI 15508–9); 6 mi. S Garnett (UK 2248). *Bourbon Co.:* (UMMZ 67020, two). *Cherokee Co.:* 4 mi. E Baxter Springs (UK 24401). *Crawford Co.:* 6 mi. N Arma (2, RBL); Pittsburg (UK 23287–90). *Doniphan Co.:* Geary Lake (UK 2244). *Douglas Co.:* Lake View (UK 27973); Lawrence (UI 17783; UK 2240, 2242, 8379, 17417; and RBL); 3 mi. S, 3 mi. E Lawrence (RBL); 5 mi. NW Lawrence (UK 7556); 5 mi. N, 1 mi. W Lawrence (RBL; HAD); 4 mi. W, 1 mi. N Lawrence (HAD); 6 mi. W, 1 mi. S Lawrence (UI 15510). *Franklin Co.:* (UMMZ 75875; MCZ 32374). *Jefferson Co.:* (UK 8388); 2 mi. E Perry (RBL); 10 mi. N, 4 mi. E Oskaloosa (RBL). *Johnson Co.:* 2 mi. E, 1 mi. S Eudora (2, HAD). *Labette Co.:* (UK 2243). *Leavenworth Co.:* Ft. Leavenworth (UK 21484). *Linn Co.:* Mound City (UK 2250). *Miami Co.:* (MCZ 32373); 3 mi. E, 1 mi. S Fontana (UK 22832; 4, RBL); 3 mi. N LaCygne (CAS 13437); 4 mi. SW Spring Hill (UK 21834). *Wabaunsee Co.:* 4 mi. W, 4 mi. S Alma (2, HAD). Intergrades with *gentilis* from Kansas as follows: *Clay Co.:* Clay Center (UK 17166). *Coffey Co.:* 5 mi. S Lebo (UK 2234). *Cowley Co.:* Winfield (CAS 7738; USNM 88769). *Geary Co.:* Ft. Riley (USNM 4760). *Marshall Co.:* 2 mi. S Blue Rapids (BYU 10281); Irving (CAS 5583; MCZ 32375); 2 mi. SE Irving (HAD). *Osage Co.:* (UK 2246). *Pottawatomie Co.:* 1 mi. NW Fostoria (4, RBL; HAD). *Riley Co.:* (UMMZ 66990); Manhattan (CAS 3762; MCZ 5423; UMMZ 64429, 75614, 96824). MISSOURI. *Jackson Co.:* (USNM 61677–8). *Johnson Co.:* Warrensburg (AMNH 67165). *McDonald Co.:* Noel (LMK 22354). NEBRASKA. *Richardson Co.:* 2 mi. S, 3 mi. E Rulo (RBL). *Washington Co.:* Arlington (UMMZ 14044). Intergrades with *gentilis* from Nebraska as folows: *Cass Co.:* 3 mi. E Weeping Water (NSM 497); 6 mi. E Weeping Water (NSM 346). *Richardson Co.:* Humboldt (NSM 1658). *Sarpy Co.:* 4 mi. SE Springfield (NSM 1423), State Fish Hatchery (RBL). *Saunders Co.:* Ashland (NSM 407). OKLAHOMA. *Adair Co.:* near Kansas (UMMZ 81332). *Cherokee Co.:* Welling (HAD). *Creek Co.:* Sapulpa (AMNH 7705; UMMZ 96826). *Mayes Co.:* (UO 25836). *Okmulgee Co.:* (UO 5466;

UMMZ 64571). *Osage Co.:* 5 mi. N Sand Springs (UMMZ 83254). *Ottawa Co.:* 3 mi. S, 4 mi. E Quapaw (RBL). *Pushmataha Co.:* Nashoba (UO 25001). *Rogers Co.:* 7 mi. W Iola (CAS 12268); 2 mi. NE Catoosa (UO 26271). *Tulsa Co.:* 1 mi. SW Redfork (UO 23237). TENNESSEE. *Obion Co.:* (UI 2155–6).

Additional Records.—(Blanchard, 1921, unless otherwise noted) IOWA. *Polk Co.:* Des Moines. KANSAS. Intergrades with *gentilis; Chase Co.:* 5 mi. SW Saffordville (Breukelman and Smith, 1946). *Greenwood Co.:* 4 mi. SW Lamont and 6 mi. S Wilber (ibid). *Lyon Co.:* (Breukelman and Clarke, 1951). *Morris Co.:* 1 mi. SW Council Grove (Burt, 1935). *Shawnee Co.:* (Smith, 1950). MISSOURI. *Jasper Co. St. Clair Co.* NEBRASKA. *Cuming Co.:* (Taylor, 1892). *Nemaha Co.:* (ibid).

Lampropeltis doliata gentilis (Baird and Girard)
Central Plains Milk Snake
Plates 1 and 2

Ophibolus gentilis Baird and Girard, Catalogue of North American Reptiles, Part 1, Serpentes, pp. 90–91, 1853, (type USNM No. 1853, from North Fork of the Red River, near Sweetwater Creek, Wheeler County, Texas, collected June 14, 1852, by Capt. Marcy); Baird and Girard, in Marcy and McClellan, Expl. Red River La., pp. 229–230, pl. 8, 1853; Baird, Pacific R. R. Survey, 10, pl. 30, fig. 64, 1859.

Lampropeltis doliata, Cope, Proc. Acad. Nat. Sci. Philadelphia 1860, p. 256 (part).

Ophibolus doliatus gentilis, Yarrow, U. S. Nat. Mus. Bull. 24: 90, 1882, (part). Ellis and Henderson, Univ. Colorado Studies, 10: 91, pl. 4, fig. 23, 1913.

Ophibolus triangulus doliatus, Taylor, Ann. Report Nebr. State Bd. Agric. for 1891, 1892, pp. 342–344 (part).

Ophibolus doliatus sysputus, Cope, Proc. Acad. Nat. Sci. Philadelphia, 1893, p. 387. Blanchard, U. S. Nat. Mus. Bull. 114:165–171, 1921 (part); Burt, Trans. Kansas Acad. Sci., 36; 200, 1933; Brennan, Trans. Kansas Acad. Sci. 37: 191, 1934; Hudson, Nebr. Conservation Bull. 24; 67–68, 1942 (part); Breukelman and Smith, Univ. Kansas. Publ. Mus. Nat. Hist., 1: 109, 1946.

Lampropeltis doliata gentilis, Klauber, Copeia, 1948: 11 (part).

Range.—Northern Texas panhandle, northeastern New Mexico, eastern Colorado, southern Nebraska, western and central Kansas, and western Oklàhoma. Intergrades with *syspila* in eastern Nebraska, Kansas and Oklahoma, with *multistrata* in southern Nebraska and southeastern

Wyoming, presumably with *amaura* in southeastern Oklahoma and northeastern Texas, and with *celaenops* in northeastern New Mexico.

Diagnosis.—Head predominantly black, complete or nearly complete triads of wide black bands surrounding a red saddle, which extends down onto ventrals or forms a complete red band; usually with black across red midventrally; black bands expanded middorsally strongly encroaching upon or uniting over red; annuli whitish, 2½–3 scales wide middorsally, slightly constricted laterally, wider to 4–5 scales on first scale row; ventrals 187–207 average 195; total annuli 26–38, males, 26–38, average 32.7; females, 26–37, average 29.4.

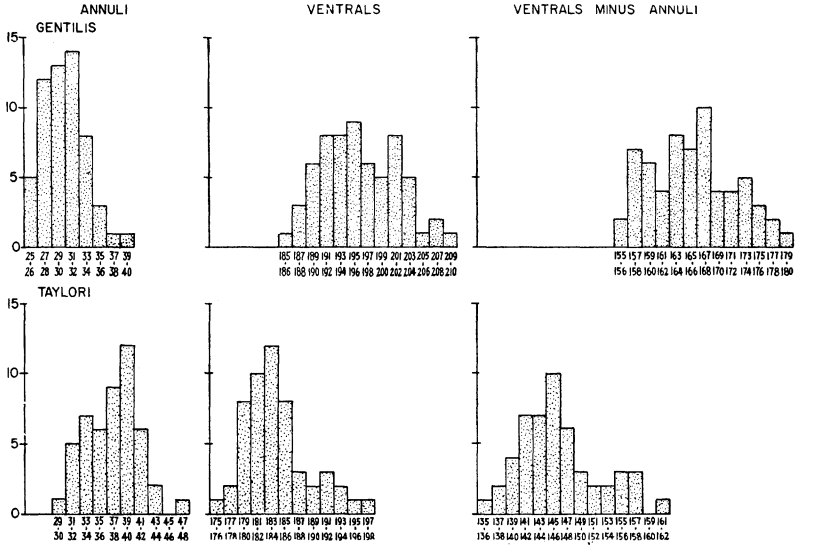

Plate 2. Variation of annuli and ventrals in the subspecies gentilis and taylori. Numbers on the vertical lines indicate number of specimens.

Redescription of type.—USNM 1853, adult male, dorsal scale rows smooth, 21–21–19–17; ventrals 197; caudals 31 (incomplete); supralabials 7–7; infralabials 9–9; one loreal; one preocular; two postoculars, dorsal largest; temporals 2–3, 2–2, anterior chinshields longer than posterior, latter separated from each other by gular scales. Dorsal head scales normal for species. Length of body 713 mm., tail 92 mm. (incomplete).

Head predominantly black over parietals, except for white posterior tips; side of snout light mottled with black, supralabials and infralabials with black around sutures, no flecks of black on chinshields.

White annuli 24 on body, 4 on tail (incomplete, probably originally 6), first annulus 3 scales wide, other annuli usually 2½, up to 3 scales

wide middorsally, slightly constricted laterally and then expanded to 4 scales on first scale row; black stippling on lateral white scales.

Triads complete with red bands or saddles usually constricted or separated middorsally by black, red 3 scales wide on first scale row, encroaching upon ventrals, red reduced or absent on posterior triads, black stippling on lateral red scales. Single black bands complete, 1 scale wide on first scale row, 2 to 2½ scales wide middorsally, each band 3 scales wide when confluent, black converges on ventrals at expense of red, confluent posteriorly to become nearly solid on belly; occasional black spots on ventrals between triads.

Description of subspecies.—The following description is based on twenty-six males and eighteen females. Ventrals 187–207, average 195, sexual dimorphism not indicated; caudals 37–57; temporals usually 2–3–4, 2–3–3, or 2–2–3, rarely 1–2 ar 1–3. Longest total length, a male 793 mm. from Boulder County, Colorado, (CU 2494); tails of males slightly longer than those of females.

Head predominantly black, particularly on dorsum; parietals, except for white posterior tips, frontal and oculars usually black, as are internasals, prefrontals and temporals bordering parietals; supralabials bordered or covered with black; infralabials with dark margins; no flecks on chinshields.

White annuli range from 26 to 38, average 31.4; body and tail rings uniform in width, slightly restricted on lateral scales, and always expanded on first two scale rows to 4–5 scales. Ventrals minus annuli total 155–176, average 164.8.

Triads usually completely surround the body, with red bands 0–6 scales wide middorsally, anterior red bands widest, posterior red bands constricted or broken by black in most specimens; red extends onto ventrals in all specimens, rarely restricted to outer edges only, frequently mottled with black midventrally, and on lateral scales of large specimens; red darker on dorsum than on ventrals.

Single black bands usually complete or nearly complete, ½–1 scale wide on first row, increasing to 1½–2½ scales wide middorsally, slightly wider to 3 scales if dorsally confluent across red of triad, confluent black usually present on dorsum of posterior triads of most specimens, occasionally with black strongly encroaching on red of ventrals, usually not to the extreme of *annulata* or *celaenops*. Triads usually complete ventrally although they occasionally fail to be completely confluent. Confluent black markings rarely present outside of triads except for stippling on lateral white scales. Black spots sometimes present midventrally, or near the

edge of first dorsal scale row on specimens from the eastern part of the range near *syspila.*

Remarks.—Although too few specimens of typical *gentilis* were seen to evaulate geographic variation properly, there does appear to be an increase in ventrals from southwest to northeast. Perhaps the character which best shows geographic variation is the number and width of the annuli. The minimum number within the subspecies is found in the southwestern part of its range (southern Oklahoma) whereas the number increases to the north and east. The width of the annuli also increases slightly from south to north. Although intergradation is not demonstrated between *gentilis* and *annulata,* the southern *gentilis* approaches *annulata* in several characters.

A specimen, USNM 4292, from Ft. Union has 191 ventrals, 28 white rings and the red is in annuli rather than saddles. The red predominates over both black and white, each red band averaging about five scales dorsally. The white bands are slightly enlarged dorsally and the black is noticeably reduced. This specimen is similar to *gentilis* although the locality is near the range of *celaenops.*

Specimens examined.—Total 79, as follows: COLORADO. *Boulder Co.*: Boulder (CU 853-5, 130-two, 2897, 1157, 534, 128); Noland, N of Lyons (CU 852); 2 mi. SE Lyons (CU 2494); Sugar Loaf (CU 1398). *Huerfano Co.*: Walsenburg (CU 1010). *Jefferson Co.*: Lookout Mt. W of Denver (CU 851). *Larimer Co.*: 1 mi. W Ft. Collins (CU 2491); 6 mi. SW Ft. Collins, (CU 2493); near Horsetooth Mt. (CU 2492). *Pueblo Co.:* Beulah (AMNH 50833). KANSAS. *Cloud Co.:* Miltonvale (UK 17067–8). *Ford Co.*: 9 mi. E Dodge City (SUNHM 9914). *Jewell Co.*: 1 mi. E Lovewell (5, HAD), 4 mi. W Lovewell (HAD). *Meade Co.*: 3 mi. WSW Meade (UMMZ 96069). *Morton Co.*: 16 mi. N Elkhart (UK 5351–4). *Osborne Co.*: 9 mi. W Osborne (UK). *Rawlins Co.:* 10 mi. N McDonald (UK 2249). *Republic Co.:* Courtland (UMMZ 67388); 3 mi. W Agenda (UK 2237). *Rice Co.*: (UK 2236). *Russell Co.*: (UK 2239; UMMZ 96827); 7½ mi. S 2 mi. E Russell (RBL). *Scott Co.*: near Scott City (KSE 510). *Wallace Co.*: (UK 2251); Wallace (MCZ 12661). NEBRASKA. *Adams Co.*: Hastings (UN 1843). *Dundy Co.*: 6 mi. E of Haigler (RBL). *Gage Co.*: 1 mi. SE Wymore (UN 1192). *Hitchcock Co.*: Trenton (RBL). *Jefferson Co.*: 4 mi. S ½ mi. W Reynolds (UN 1433–4; 4, RBL). *Lancaster Co.*: Lincoln (UN 203). *Thayer Co.*: near Williams (UN 1834; 12, RBL). *Webster Co.*: Red Cloud (UN 330–1). NEW MEXICO. *Mora Co.*: Fort Union (USNM 4292). OKLAHOMA. *Beckham Co.*: 2 mi. E Sayre (USNM 92625). *Cleveland Co.*: 3 mi. S Norman (UO 19019).

Comanche Co.: Wichita Mt. Wildlife Refuge (UO 26611, 26657–8). *Garvin Co.*: Mayesville (UO 10474). *Oklahoma Co.*: (UO 962). TEXAS. *Wheeler Co.*: near Sweetwater Creek, North Fork of Red River (type, USNM 1853).

Additional records.—(Blanchard, 1921, unless otherwise noted) COLORADO. *Baca Co.*: (Ellis and Henderson, 1913). *Las Animas Co. Morgan Co.*: Orchard (Ellis and Henderson, 1913). *Weld Co.*: Eaton. *Yuma Co.*: Dry Willow Creek. KANSAS. *Ellis Co.*: (Brennan, 1934). *Gove Co.*: (Blanchard, 1924) Fair Grounds (Breukelman and Smith, 1946). *Sedgwick Co.*: Mount Hope (Burt, 1933). *Stevens Co.*: Hugeton (ibid). NEBRASKA. *Adams Co.*: near Bladen (Hudson, 1942). *Franklin Co.*: Franklin (ibid). *Red Willow Co.*: (Taylor, 1892). OKLAHOMA. *Blaine Co.*: Gyp hills near Watonga (Dundee, in Litt.). *Kingfisher Co.*: Hennessey (Cope, 1893).

Lampropeltis doliata multistrata Kennicott
Pale Milk Snake
Plate 1

Lampropeltis multistriata Kennicott, Proc. Acad. Nat. Sci. Philadelphia, 1860, pp. 328–329 (type, USNM no. 1842, from Fort Lookout 'Nebraska', now in Lyman County, South Dakota, collected by Lieut. Warren and F. V. Hayden); Hayden, Trans. Amer. Philos. Soc., 12:177, 1862.

Lampropeltis multistrata, Kennicott, Proc. Acad. Nat. Sci. Philadelphia, 1860, p. 566, ("We are authorized to state that *Lampropeltis multistriata* Kennicott, 1. c. p. 328, is a misprint for *L. Multistrata* Kenn.").

Ophibolus multistratus, Coues and Yarrow, U. S. Geol. and Geog. Survey Terr. Bull. 4:284, 1878.

Lampropeltis triangulum gentilis, Blanchard (part), U. S. Nat. Mus. Bull. 114: 165–171, 1921 (part); Hudson, Nebr. Conservation Bull. 24: 67–68, 1942 (part); Nelson, Herpetologica, 4:170, 1948; Nelson, Herpetologica, 6:41, 1950.

Lampropeltis doliata gentilis, Klauber, Copeia, 1948: 11 (part).

Range.—Northwestern Nebraska, western South Dakota, eastern Wyoming and southeastern Montana. Intergrades with *gentilis* in southern Nebraska and southeastern Wyoming, with *syspila* in northeastern Nebraska and probably southeastern South Dakota.

Diagnosis.—A general reduction of black, producing a pallid appearance, incomplete triads with venter immaculate or with only a few black markings; anterior dorsal triads reduced in width; triads with

orange (replacing red of *gentilis* and *syspila*) bordered by black; annuli wide (2½–3½ scales), cream white to yellow. Dorsum of head with a small black cap, snout light. Ventrals 189–204. Total white annuli in males, 36–43, average 38.5; females, 31–37, average 34.1. Ventrals minus annuli total 151–172.

Redescription of type.—USNM 1842; subadult male, ventrals 198; caudals 48; supralabials 8–8, 4th and 5th entering orbit; temporals 2–3–3, 2–3–4. Head slightly distinct from neck, snout depressed; tail 40 mm., total length 323 mm.

Color of dorsum of head light, with a small dorsal cap extending forward from anterior two thirds of parietals, to just anterior of eyes, laterally down to tip of 8th supralabial. Snout light with black flecks. Present condition of color pattern extremely faded. Body with 30 (including first triad as completely, instead of partially divided), body and tail with 38 whitish annuli, dorsally 1½–2 scales wide, expanded to 4–5 scales wide on first scale row; lateral whitish scales with faint trace of black flecks. Triads composed of two black bands separated dorsally and laterally by 'reddish' (brownish red in spirits, according to Kennicott, 1860) blotches (whitish now), not extending down upon ventrals; black completely or nearly completely surrounding 'red,' extending only slightly upon ventrals; belly nearly immaculate with some black markings faintly visible. Black bands only slightly expanded dorsally and do not meet across 'red.'

Description of subspecies.—The following description is based on 18 typical specimens. Ventrals 189–204, average 194.8, males 190–199, average 193.3, females 189–204, average 197.3; caudals 44–52, males 47–52, average 48.8, females 44–47, average 44.7; supralabials 7–7, rarely 8-8 (type); temporals usually 2–3–3 or 2–3–4, rarely with anterior reductions.

Total length 182 to 713 mm.; one female, 754 mm., an intergrade (*multistrata* × *gentilis*).

Head predominantly light, usually with a small black dorsal cap, extending forward from parietals to just anterior of eyes; snout light, mottled with black and orange. Some black on sutures of scales on the head and infralabials, but reduced in extent.

White annuli range from 31 to 43, average 36, males 36–43, average 38.5, females 31–37, average 34.1; annuli range from 1½–3½ scales wide middorsally, expanded to 4–6 scales wide on lower scale rows, annuli nearly uniform on a single specimen.

Triads split dorsally by orange saddles which vary from 0 to 4 scales in width (average 2½ scales) on dorsum, becoming narrower on lateral

scales and usually extending only slightly below first scale row onto ventrals, orange rarely mottled with black flecks laterally. Black bands usually slightly expanded on dorsum occasionally confluent middorsally across orange; single black bands usually 1–1½ scales wide middorsally to ½–0 scales wide on first scale row; black usually extends onto ventrals, but rarely connects across belly; ventrals with some black spots or markings, but generally with a pallid appearance.

Comparisons.—The northern race *multistrata* is closely related to the two adjacent subspecies, *gentilis* and *syspila.* It differs from *gentilis* (from the southern part of its range) in the high number of annuli, reduced amount of black in the head pattern, orange coloration replacing red, reduction or absence of a ventral pattern, with no complete triads, and little or no orange extending onto the ventrals. From *syspila,* it differs in the complete or nearly complete absence of small lateral blotches, orange coloration, general faded appearance, absence of any pronounced red blotch on dorsum of the head, and an increase in number of annuli.

The region of intergradation between *multistrata* and *gentilis* appears to be in southeastern Wyoming and southern Nebraska. Two specimens from Platte County, Wyoming (UW) seem to be intermediate and an individual from west central Nebraska, (UN 271, Keith Co.) also is intermediate in several characters. Specimens from southwestern Nebraska and extreme northwestern Kansas represent *gentilis* which approach *multistrata* in the generally pallid condition, the reduction of width of the ventral part of the triads, and reduction of black on the head.

Intergradation between *multistrata* and *syspila* seems to occur in northeastern Nebraska and possibly in southeastern South Dakota. Specimens from the area around the mouth of the Niobrara River in Nebraska (Boyd and Holt counties) seem to approach *syspila* in having the small lateral blotches on the posterior part of the body. Some specimens of *multistrata* to the west of these counties also have traces of these lateral blotches, but there is never a light center in each blotch.

Remarks.—We have used the spelling of *multistrata* instead of *multistriata,* as originally proposed, since there is a note (Kennicott, 1860:566) at the end of a paper by E. D. Cope, stating that the original name was a misprint. This correction has been recognized by some subsequent workers. The type locality was originally listed as Fort Lookout, Nebraska, but Coues and Yarrow (1878:284) state that "The locality of the original specimen is stated by its discoverer to be Fort Benton, Montana, not 'Fort Lookout, Nebraska'." Actually Hayden

(1862:177) merely listed *multistriata* under the locality without further mention. We have accepted the type locality as originally stated, but actually the snake might have been collected at almost any point from Fort Lookout to Fort Benton. We feel that the type specimen is a representative of the subspecies we are calling *multistrata,* since both localities and the route between them are all conceivably within the range we have outlined, rather than that of any other subspecies.

The failure of Blanchard (1921) to recognize *multistrata* probably resulted from his seeing only four preserved specimens of this subspecies, all from the southern port of its range, and in having few typical *gentilis* for actual comparison. Hudson (1942:67) apparently was the first worker to recognize a difference in the specimens from northwestern Nebraska (*multistrata*) from those of south central Nebraska (*gentilis*), but considered them intergrades with the eastern *syspila.* Actually some of the specimens he examined from northeastern Nebraska are intergrades, but between *multistrata* and *syspila,* not between *syspila* and *gentilis.*

This pallid subspecies is found in the sand hill region of Nebraska and South Dakota and northwestward into the arid high plains to the Rocky Mountains. It seems to be smaller than either *gentilis* or *syspila.*

Specimens examined.—Total 37, as follows: MONTANA. *Custer Co.:* 17 mi. SE Miles City, on Pumpkin Creek near U. S. Highway 212 (BYU 12140). NEBRASKA. *Banner Co.*: Harrisburg (CNHM 2087). *Boyd Co.*: Anoka (UNSM 282), considered an intergrade with *syspila. Cherry Co.*: (NSM 2); Fort Niobrara (USNM 16108); near Valentine (2, RBL); 20 mi. S 4 mi. W Valentine (RBL). *Custer Co.*: 9 mi. NW Gallaway (UN 342). *Garden Co.*: Blue River (=Blue Creek) (AMNH 8788). *Holt Co.*: Niobrara River north of O'Neill (UN 26); Stuart (USNM 108986), both being considered as intergrades with *syspila. Keith Co.*: 6 mi. NW Keystone (UN 271), an intergrade with *gentilis. Scotts Bluff Co.*: 2½ mi. NE Morrill (UN 324). *Sheridan Co.*: Gordon (UN 1143); 15 mi. SE Gordon (UN 513); Rushville (UN 88). *Thomas Co.:* Halsey, in Nebraska National Forest (RLB). SOUTH DAKOTA. *Lyman Co.*: Fort Lookout (type, USNM 1842). *Pennington Co.:* Scenic (MCZ 22410); 10 mi. N Wall (LMK 23183). *Todd Co.*: Hidden Timber (CAS 11314). *Hughes Co.*: Pierre, doubtful records based upon two specimens (UMMZ 75615, hatchling and 75641) originally presented to Dr. H. K. Gloyd by the late Mr. A. M. Jackley. They do not conform to any of the other specimens from within the range of *multistrata,* but appear similar to *gentilis.* WYOMING. *Goshen Co.*: Horse Creek (MCZ 31646). *Platte Co.*: Sibille Canyon (UW);

20 mi. SW Wheatland (UW), both considered as intergrades with *gentilis*. *Sheridan Co.*: near Sheridan (UW 129). *Washakie Co.*: 10 mi. E Worland (RBL).

Additional records.—MONTANA. *Carbon Co.*: Red Lodge (Nelson, 1948). *Gallatin Co.*: Three Forks (Nelson, 1950). *Yellowstone Co.*: Billings (Nelson, 1948). *Chouteau Co.*: Fort Benton, a questionable record (Hayden, 1862). NEBRASKA. *Buffalo Co.*: 4 mi. NE Pleasanton (Hudson, 1942). *Cherry Co.*: 5 mi. N Valentine (ibid). SOUTH DAKOTA. *Dewey Co.*: Timber Lake (Over, 1923). *Tripp Co.*: 18 mi. NW Winner, possibly *syspila* as suggested by Anderson (1947). WYOMING. *Albany Co.*: approx. 25 mi. N Laramie (Nelson, 1950).

Lampropeltis doliata celaenops Stejneger
New Mexico Milk Snake
Plates 1 and 3

Lampropeltis pyrrhomelaena celaenops Stejneger, Proc. U. S. Nat. Mus., 25: 153, 1903, (type, USNM no. 22375, from Mesilla Valley, Dona Ana County, New Mexico, H. B. Lane collector).

Lampropeltis triangulum gentilis, Blanchard, U. S. Nat. Mus. Bull. 114: 165, 1921, (part).

Lampropeltis doliata gentilis, Klauber, Copeia, 1948: 11, (part).

Ophibolus doliatus annulatus, Yarrow, Report U. S. Geol. and Geogr. Surv., W 100th Meridian, 5:537, 1875, (lists two specimens from Camp Apache (Fort Apache), Arizona).

Range.—Known only from the Rio Grande Valley of southern and central New Mexico, *celaenops* probably occurs throughout southern New Mexico, extreme western Texas and in Chihuahua, Mexico. A record, possibly of this subspecies, exists from Ft. Apache, Navajo County, in eastern Arizona. Intergradation with *taylori* and with *gentilis* is indicated in northern New Mexico.

Diagnosis.—Dorsum of head black; triads with black bands expanded middorsally and ventrally, the belly with black bars of 3–4 ventrals alternating with the expanded white bars of 2–3 ventrals in width; red extending only to lateral edge of ventrals and being surrounded by black; black of first triad united laterally and in the type specimen, ventrally; white annuli expanded middorsally by 1–3 scale length more than their dorsolateral width; first annulus expanded 3–5 scales middorsally; annuli few, 30–33; ventrals few, 173–181.

Redescription of type.—Dorsal scale rows 21–21–19, reduction to 19 rows by combination of rows 4–5 at 132 ventral on left side, rows 5–6

at 131 ventral on right side, dorsal scales smooth, finely striated and with two apical pits; ventrals 178; caudals 47; temporals 2–3–3, dorsal scale in third row 2–3 times larger than its members.

Head distinct from neck, but not sharply constricted; total length 562 mm.; tail 88 mm., which is 15.3 percent of total length.

Color of dorsum of head uniformly black, except for white on tips of parietals, lower surfaces of rostral, labials, loreal, and lateral edge of prefrontals with light markings; anterior chinshields flecked with black; infralabial sutures margined with black. Body with 23 and tail with 7 whitish annuli, dorsally 3–5 scales across, constricted to 1½–2 scales dorsolaterally and expanded to 3–5 scales at first scale row and onto ventrals; lateral whitish scales noticeably flecked and mottled with black. Triads composed of two black bands separated dorsally and laterally by red blotches (whitish in alcohol); ventrally the black bands unite to form elongate irregular black bars, approximately equal in width to white annuli on ventrals, limiting red to dorsal scales and edges of 1–3 ventrals; black bands of triads expanded middorsally encroaching upon the red in most and confluent in nine triads. Triads longest dorsolaterally, because of the middorsal expanding in the annuli.

Comparisons.—*Celaenops* is closely related to the three adjacent subspecies, *annulata, gentilis,* and *taylori.* The relatively few ventrals and the expanded annuli on the dorsum and sides readily separate it from *annulata* and most *gentilis,* the former also having a lower annuli count. It differs from *taylori* in having a combination of few ventrals and few annuli, in the dorsally expanded annuli and in the enclosed red saddles, thus forming characteristic black and white ventral bars.

Remarks.—The original description of *celaenops* is brief. Through the courtesies extended to us by the curators of the United States National Museum, we have been able to examine the type specimen of *celaenops,* which is still in good condition. Stejneger (1903) stated in the original description that this subspecies was also in eastern Arizona, presumably based upon USNM 8435 from Camp Apache, (=Fort Apache, Navajo County)* Arizona (originally reported by Yarrow, 1875). Unfortunately this specimen is no longer in existence, but the following pertinent data are given by Blanchard (1921:170); ventrals 190, caudals 44, total annuli 29, juvenile female. An allocation of this specimen, based solely upon these data, would be with the subspecies *gentilis,* however, the data are near the extremes exhibited by both *celaenops* and *taylori.* The re-

*This locality was incorrectly mapped by Blanchard (1921:167) at the present site of the town of Apache in Cochise County. Camp Apache was changed to Fort Apache in 1879 and is located in Navajo County.

duced annuli and its geographical nearness suggest a closer relationship to *celaenops*. Since the specimen is no longer available, we have not included this record under any subspecies.

The few specimens from Bernalillo and San Miguel Counties in New Mexico appear to be intergrades. A juvenile female from Las Vegas, (OAM 266) is similar to *taylori* in the number of white bands (37), but has a slightly enlarged first annulus (3½ scales) and the white body bands are expanded dorsally. The ventrals are few (173) and the black constricts the red laterally to form saddles rather than complete rings on the ventrals. Except for the number of white rings this specimen approaches *celaenops*.

A female from Sandia Park, Bernalillo County is here considered as belonging to *celaenops*. It has 180 ventrals, 33 white bands, many of the white rings are enlarged dorsally and the black bands converge laterally to encircle the red saddles, a condition seldom observed in *taylori*, but typical in *celaenops*.

A specimen from the Mesa Verde National Park, Colorado, approaches *celaenops* in the following characteristics: the first annulus is expanded to 4½ scales; except for the first triad the black unites to form bars ventrally, there are 33 annuli and 175 ventrals. A specimen from Cortez, Colorado, is almost identical to the park specimen: 34 annuli, 176 ventrals and with all but the first two triads forming lateral and ventral black bars. In the latter, however, the first annulus is only 3 scales dorsally and in neither do the annuli expand to any extent middorsally.

With so few specimens from extreme southwestern Colorado and northwestern New Mexico, it is impossible to establish the zone of intergradation. It is suspected that the zone may extend over a rather wide area including the above areas and may extend into the Monticello area of southeastern Utah.

Specimens examined.—Total 7, as follows: NEW MEXICO. *Dona Ana County:* Mesilla Valley (USNM 22375); between Mesilla Park and Las Cruces (USNM 102266). *Bernalillo County:* Sandia Park (WJK); Sandia Mts., Cedro Canyon (WJK). *San Miguel County:* Las Vegas (OAM 266). COLORADO. *Montezuma County:* Cortez (MVNP); Mesa Verde National Park (MVNP), intergrades *celaenops* and *taylori*.

*Lampropeltis doliata taylori** subsp. nov.
Utah Milk Snake
Plates 1, 2, 3 and 4

*Named in honor of Dr. Edward H. Taylor, University of Kansas, our friend and teacher.

Holotype.—Brigham Young University no. 10533, adult female, from approximately 2 miles north of Alpine, Utah County, Utah, collected May 24, 1951, by Wilmer W. Tanner.

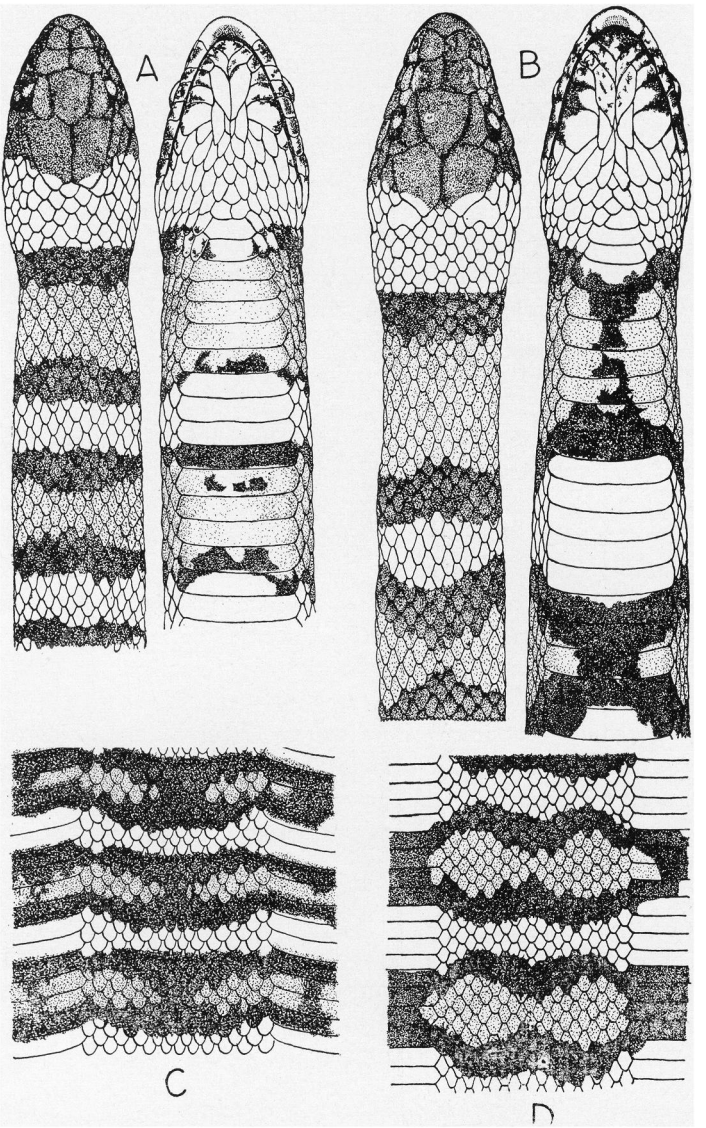

Plate 3. Lampropeltis doliata: A—taylori, paratype, Panguitch, Garfield Co., Utah, BYU 8923; B—celaenops, type, Mesilla Valley, Dona Ana Co., New Mex., USNM 22375; C—taylori, type, 2 miles north of Alpine, Utah Co., Utah, BYU 10533; D—celaenops, type. Typical color patterns for both subspecies except for the first annulus in A which is extreme for taylori.

Paratypes.—Thirty-four paratypes as follows: UTAH. *Carbon Co.:* Helper (BYU 2933). *Duschesne Co.:* Neola (BYU 163, 11114); Ioka (BYU 11101); 6 mi. N Neola (BYU 11103); near Lake Borham (BYU 11102). *Garfield Co.:* Panguitch (BYU 8923). *Iron Co.:* Cedar City, (Cal. AS); *Juab Co.:* Benmore (BYU 8922); 8 mi. S Eureka (UU 3018). *Salt Lake Co.:* near Lark (UU 1413); Butterfield Canyon (UU 1430; Copperton (UU 3223). *Sanpete Co.:* Fountain Green (UMMZ 64685); Mt. Pleasant (BYU 2929); S edge Ephraim (BYU 11117). *Tooele Co.:* Tooele (UU 317); Tooele Valley (BYU 334). *Uintah Co.:* Vernal (BYU 11104; KU 38952; and UU 70); Rainbow (MCZ 38247), approx. 5 mi. SE White Rocks, (BYU 11116); *Utah Co.:* Provo (BYU 333; MCZ 9035); Spanish Fork (BYU 336); 3 mi. E Thistle (BYU 337, 398, 1505); Hobble Creek Canyon (BYU 520); foot hills N of Lehi (BYU 2718); Alpine (BYU 2756); Cedar Valley (BYU 2930); Payson (BYU 6023); Rock Canyon (BYU 11100); mouth Pole Canyon (UU 1963); 7.6 mi. E Springville (MVZ 49929–30). *Wasatch Co.:* Wallsburg (UU 318). *Washington Co.:* Pine Valley (BYU 389).

Range.—Central and eastern Utah south of Salt Lake City and Vernal (except for the more arid desert areas), western Colorado and northern Arizona in the Colorado River drainage and intergrading with *celaenops* in southwestern Colorado and northwestern New Mexico.

Diagnosis.—Head black or mottled; annuli 30–48 (average 37.4); first annulus usually not more than 3 scales long; triads complete or nearly complete ventrally, usually with red across ventrals if complete; first triad usually possessing a complete red band with first or both black bands incomplete ventrally and not connected laterally; most triads with black encroaching upon red middorsally, frequently becoming confluent; dark flecks frequently upon chinshields; infralabials more often 9–9, but commonly with 8 on at least one side; ventrals 175–198, usually between 180 and 190, average 184.3.

Description of type.—Dorsal scale rows smooth, 21–23–21–19; increased to 23 rows at level of ventral 56, a new row on both sides between rows 5 and 6 for 54 ventrals, reduction to 19 rows at level of ventral 171 by uniting rows 4 and 5 on each side. Ventrals 185, 5 pairs of gulars between first ventral and posterior chinshields; anal entire; caudals 43. Supralabials 7–7; infralabials 8–9; preoculars 1–1; postoculars 2–2; temporals 2–3–3; loreal single, longer than high; nasal large and divided vertically; mental triangular, not reaching anterior chinshields; anterior chinshields longer than posterior, posterior pair separated by three small gulars; other head scales normal for species.

Head distinct but neck not prominently constricted; body cylindrical

and tapering. Total length 474 mm., tail 71 mm., ratio of tail to total length approximately .15.

Head with black and reddish mottling between and anterior to eyes, parietals black except for extreme posterior tips and anterior margins near supraoculars; anterior temporals, fifth and sixth supralabials black; posterior tips of parietals, middle and posterior temporals, and posterior supralabials in first white band; supralabials below and anterior to eye mottled with reddish and black; infralabials cream with a few blackish-brown spots and dark margins; anterior chinshields and mental with small dark spots.

Pattern with 42 white annuli, 8 of these on tail; first annulus 2 scales long dorsally, other annuli 2–2½ scales long and uniform in width from about the second scale row across the dorsals; 8 triads lack red entirely and only 3, first and last body and first tail triads, with red

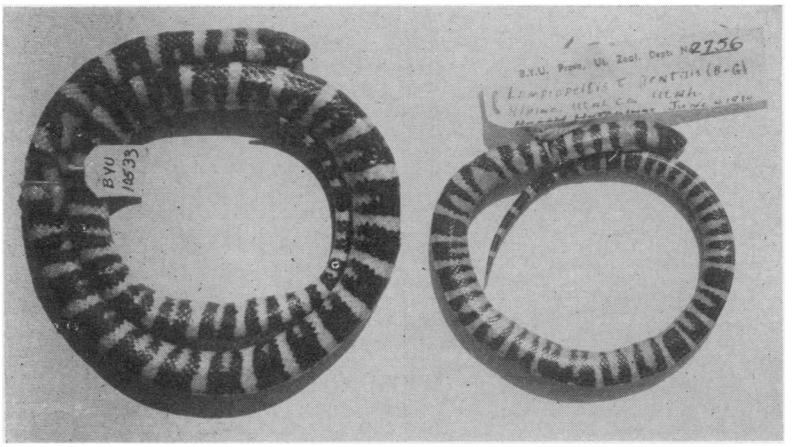

Plate 4. Lampropeltis doliata taylori, type, BYU 10533; paratype from Alpine, Utah Co., Utah, BYU 2756.

completely across dorsum, with red 2–2½ scales wide middorsally; others with only narrow lateral red areas, all but six of them extending to or onto ventrals, red bright Peach Red dorsally, fading to pale Coral Red on ventrals (Colors from Ridgway, 1912). Red complete or partially complete across ventrals in 20 triads of body and two on tail, forming irregular rings and thus partially preserving triad pattern across ventrals.

Description of subspecies.—Smooth dorsal scale rows with most common formula, approximately 51 percent, 21–21–19–17; 25 percent with 21–21–19–19; a few specimens with 18 rows anterior to vent. Reductions usually along rows 4–5 or 5–6, and reduction from 21 to 19 rows (those with 21–21–19–17 rows) usually near 50th ventral anterior

to vent; reduction to 17 rows between vent and 34th ventral anterior to it. Ventrals 175–198, average 184.3, males average 185.2, females average 183.7; caudals 38–53, average 44.7, males 41–51, average 47.2, females 37–53, average 43.7; supralabials 7–7, rarely 8; infralabials usually 9–9, 47 percent with 8–8 or 8–9, rarely 9–10; temporals usually 2–3–4, 2–3–3 or 2–2–3.

Total length ranges from 180 to 677 mm., ratio of tail to total length varies from .130 to .150, tail lengths of males average slightly longer than those of females.

Head predominantly black, particularly on dorsum; parietals, except for white posterior tips, frontal and oculars usually black; internasals and prefrontals black, occasionally mottled with red, supralabials black or margined with black; infralabials with dark margins and flecks, chinshields usually flecked with dark markings. Throat White to Straw Colored to Light Salmon Red in region of first red band.

White annuli range from 30 to 48, average 37.4, with no significant sexual difference; 24 to 40 on body, average 29.6; 6 to 10 on tail, average 8.1; rings on both body and tail uniform in width 1½ to 2½ scales middorsally, seldom more than ½ scale difference over a single specimen; some annuli slightly enlarged middorsally, however, most specimens with annuli uniform (plate 3, A and C) in width from approximately third scale rows across dorsum, always expanded on first two scale rows and on edges of ventrals; annuli without black flecking laterally; nuchal annulus variable middorsally, ranging from ½ to 4 scales in width, average 2.25, usually less than 3 and rarely absent from posterior tips of parietals. Total ventrals minus annuli, ranges from 138 to 161, average 146.7. Only ten percent are above 155 and thus overlapping the lower limits of *gentilis* and *multistrata.*

Red bands 0 to 6 scales wide middorsally; first red band usually widest, and occasionally the only band complete across dorsum; four specimens with all red bands complete dorsally, several with only a few divided, but always with a dorsal constriction of red by some of the black bands; usually most red bands extend onto ventrals in all specimens; anterior red bands complete, frequently in contact with white on ventrals; red always darker on dorsum than on belly, BYU 10534, from Arizona, had the following red colors in life; Dragon's blood Red on dorsum blending to Coral Red laterally. Black bands complete or incomplete, single black usually 1½ scales wide at dorsum, reduced to 1 to ½ scale wide on first row, usually not connected laterally to enclose red, but becoming progressively more prominent posteriorly to form some complete black bands at the expense of the red; approximately one half of

specimens with some incomplete black bands; many others with much irregularity of black markings on belly, producing a diffusion of black, red and white.

Remarks.—There is considerable variation in the number of ventrals between the specimens from the Colorado River drainage and those from the Great Basin. The ranges of ventrals between the two regions do, however, overlap. Great Basin specimens range from 181 to 198, average 187; whereas those from the Colorado River drainage region range from 175 to 186, average 180.4. This indicates that the range and average of ventrals are lower in specimens from eastern Utah and western Colorado, than in specimens from western Utah or typical *gentilis* to the east, but are close to the expected number of ventrals in *celaenops* to the south.

The comparison of the two groups of specimens on the basis of the number of annuli, shows no significant difference. The total number of annuli ranges from 30 to 44 in specimens from the Great Basin, whereas specimens from the eastern Utah-western Colorado region have from 33 to 48 annuli, with the average in both cases being approximately 37.

The nuchal annulus varies in dorsal width from ½ to 4 scales throughout the subspecies. There is a tendency in the southern and eastern specimens to have a wider ring, similar to that seen in *celaenops.* Also the red is completely enclosed by black in a larger number of triads, although the black does not become the most prominent color on the venter.

Specimens examined.—(In addition to the holotype and 34 paratypes listed above): Total 14, as folows: ARIZONA. *Coconino Co.*: 37 mi. N Flagstaff (BYU 10534); 33 mi. N Flagstaff (MVZ 16416). COLORADO. *Delta Co.:* Delta (USNM 88798). *Mesa Co.:* near Grand Junction (CNHM 18193), 3 mi. S Fruita (BYU 11106). UTAH. *Duschesne Co.:* Montwell (BYU 11115). *Salt Lake Co.:* (UU 331). *Sanpete Co.:* Moroni (UU 90). *Tooele Co.:* Tooele (UU 426). *Uintah Co.:* Vernal (UU 71, 609; MVZ 30352). *Utah Co.:* (MCZ 4788); Hobble Creek Canyon (BYU 2924).

Lampropeltis doliata nelsoni Blanchard
Sinaloa Milk Snake
Plate 1

Lampropeltis triangulum nelsoni Blanchard, Occas. Papers Mus. Zool. Univ. Michigan, 81:6, fig. 1, 1920, (type USNM no. 46552, from Acámbaro, Guanajuato, Mexico, E. W. Nelson, collector.); Blan-

chard, U. S. Nat. Mus., Bull. 114: 115, fig. 65, 1921; Bogert and Oliver, Bull. Amer. Mus. Nat. Hist., 83:368, fig. 4, 1945.

Lampropeltis doliata nelsoni, Klauber, Copeia, 1948:11.

Range.—Colima, Michoacán, and Guanajuato, north to southern Sonora along the Pacific Coast.

Diagnosis.—Ventrals many, 200 to 221, average 215.3, caudals 42 to 56, scale rows usually 21–21–19(17); white or yellow annuli 13 to 24; first triad wide, red bands wide on body; black, yellow and most red bands complete on belly, red may be completely replaced by black on tail; black somewhat wider on dorsum, at expense of red, snout mottled or light. Scales in red areas never with black tips.

Remarks.—Thirteen specimens were seen by the senior author and along with data recorded by Blanchard (1921) form the basis for the diagnosis and range. The additional data are essentially as summarized by Blanchard (*op. cit.*) except that there are fewer infralabials (usually 8–8 or 8–9). Also we were fortunate in having a few specimens of *arcifera* (UI) for comparisons.

Specimens examined.—Total 13, as follows: MEXICO. *Jalisco*: near Cerro de la Bolsa on road to La Yesco (AMNH 19647); Road from Hostotipaquillo to Cinco Minas (AMNH 19649); Hacienda de Capulines, Jamay (AMNH 19650); Hostotipaquillo (AMNH 19701); near Magdelena (19702); W of W end Lake Chapala (AMNH 71364). *Sinaloa:* Escuinapa (AMNH 3525–28); One mile NW of Guamuchil (BYU 13180). *Sonora*: Guirocoba (AMNH 63713–14).

Key to the Subspecies of Lampropeltis doliata in the United States and Northern Mexico

1. Body pattern with dorsal saddles or blotches of red or brown enclosed by black 2
1′ Body pattern with triads, complete or nearly complete across ventrals 4
2. Head and neck with Y or V-shaped marking, body with two lateral rows of small spots ..... *triangulum*
2′ Head and neck without Y or V-shaped marking, body with one or without lateral row of small spots 3
3. A single row of small lateral spots or blotches on body ..... *syspila*
3′ Without small lateral spots on body ..... *temporalis*
4. Dorsal scales with 19 or less rows ..... *doliata*
4′ Dorsal scales with 21 or more rows 5
5. Whitish annuli on body and tail total 26 or less; black of triads only slightly encroach red on middorsal line 6

5′ Whitish annuli total 26 or more; black of triads encroach red on middorsal line 7
6. Triads with red restricted to dorsal and lateral scales, black bands complete and covering ventral part of triad, only slightly enlarged middorsally; head, including snout black ..... *annulata*
6′ Triads complete with wide red bands and narrow black bands, or if triads incomplete, red onto ventrals; snout usually light red or whitish ..... *amaura*
7. Ventrals 175–205; infralabials usually 9–9 8
7′ Ventrals 205–230; infralabials usually 8–8 ..... *nelsoni*
8. Triads not completely united across ventrals, red replaced by orange; belly light, with few black spots, frequently immaculate; head with small black cap, snout light orange or whitish ..... *multistrata*
8′ Triads united across ventrals, with black bands constricting or separating red bands on the middorsal line, head with widespread black coloration 9
9. Ventrals 189 or more; white annuli usually total 26 to 38; ventrals minus annuli usually more than 160, average 165; no black flecks on anterior chinshields ..... *gentilis*
9′ Ventrals usually 190 or less; white annuli total 30 to 48; ventrals minus annuli less than 160, usually 140–155; black flecks frequently on anterior chinshields 10
10. First white annulus 3–5 scales on middorsal line; other annuli expanded on the middorsal line; triads with black bands united ventrally and laterally; ventral part of triads black ..... *celaenops*
10′ First annulus 1–4 (usually less than 3) scales wide at middorsal line, body annuli not expanded middorsally; triads with black bands frequently incomplete ventrally ..... *taylori*

Intraspecific Relationships

Although a complete discussion of the phylogeny and subspecific relationships of *L. doliata* is beyond the scope of this paper, we feel that a review of the affinities of the subspecies in the United States would be appropriate. As mentioned above, *L. d. annulata* seems to possess the characteristics and geographic location to represent the ancestral form for all subspecies to the north.

Several separate lines seemed to have radiated from *annulata* or an ancestor like *annulata.* One of these lines consists of *amaura* and *doliata* which inhabit the lowlands of the Gulf and Atlantic coastal regions. In this line, the characteristics include wide and relatively few triads, with the red areas being expanded (frequently forming complete red bands).

In addition, the head pattern consists of a greater amount of red, with less black. The number of ventrals decreases toward the north and east in each range and there is a decrease in the number of scale rows in the southeastern *doliata.* The subspecies *temporalis* seems to represent a race which is intermediate between the banded *doliata* to the south and the blotched *triangulum* to the north and west. Intermediate populations between *annulata* and *amaura* presumably occur along the zone of transition between the western shrub-hardwood and the eastern mixed conifer-hardwood forests.

North of *annulata,* a second group consists of four subspecies. Directly north is *gentilis* of the Great Plains which closely resembles *annulata* (and also *amaura*) in pattern although it possesses a greater number of narrower triads. The red is narrower and the black encroaches and unites on the dorsum across the red. The black is reduced in amount on the ventrals and also on the head. The number of ventrals are also fewer than the number found on *annulata.* Directly north of, and intergrading with *gentilis* is *multistrata* which possesses even less black on the head and body and with the red coloration being replaced by orange. In addition, the triads are more numerous and are frequently incomplete ventrally.

East of, and intergrading with *gentilis* is *syspila,* which differs in having the triads modified as large dorsal blotches which alternate with a single lateral row of small light centered spots. A wide area of intergradation occurs between these subspecies and the change of pattern from bands to blotches is gradual. In addition, the head pattern possesses more red and the snout is mottled with black, white, and frequently red. *Syspila* also intergrades with *multistrata* and possibly with *amaura* to the south, and with *triangulum* to the east.

In *triangulum,* two lateral rows of spots occur in addition to the dorsal blotches. Frequently the color changes from red in the young to brown in the adult milk snake. As previously mentioned *triangulum* intergrades with *temporalis,* the latter being intermediate between the former and *doliata.*

The third line from *annulata* consists of *celaenops* and *taylori* to the north and west. This line closely resembles annulata (and *gentilis* as well) in the general pattern of the body and head. There is a gradual reduction of the amount of black on the body, particularly the ventrals, and on the head. The triads are more numerous and narrower in these subspecies, with the red being reduced and the black being confluent middorsally. The number of triads tend to increase from south to north.

The number of ventrals is low in the southern subspecies (*celaenops*) whereas the number increases to the north and west.

Interspecific Affinities

Among the species of the *Lampropeltis doliata* group (as defined by Smith, 1942) are three species, *doliata, pyromelana,* and *zonata,* each inhabiting large areas in western North America. Their distribution is allopatric, except for the overlapping ranges of *pyromelana* and *doliata* in Utah and eastern Arizona. Blanchard (1921), Smith (1942), Zweifel (1952), and Tanner (1953) have considered the possible relationships of these and other related species. The latter two authors approached the problem after having studied *zonata* and *pyromelana* respectively. According to Zweifel (*op. cit.*), *zonata* is most closely related to *doliata* (*L. d. taylori*) and may be conspecific with it. This conclusion was based primarily on the similarity of color patterns: head mostly black (snout not white), and the pattern of the triads. Also these species are similar to each other in the ratio of tail to total length and in the numbers of caudals and annuli. They approach each other in the numbers of ventrals and both have individuals with 21 or 23 scale rows. It seems important to note that the greatest number of ventrals of *L. d. taylori* was possessed by specimens from the extreme northwestern edge of its range (Tooele and Salt Lake counties), and that an increase in ventrals can be seen from southeast to northwest. However, the average number of ventrals of *L. z. multicinta* and of *L. d. taylori* are separated by approximately 30 scales.

Lampropeltis pyromelana also is similar to *zonata* in several respects, including the triad pattern, numbers of annuli, the usual uniformity of the annuli (not markedly expanded laterally), and numbers of ventrals and scale rows (see Table 1.). However, it differs in two important characters, the white snout and a higher ratio of tail to total length.

As pointed out by Tanner (*op. cit.*) *L. doliata nelsoni* should be considered as a possible ancestral line for *zonata.* A comparison of important characteristics (Table 1) reveals close similarities in all characters save in the number of annuli and the percent of red in the triads. The wide separation of the present ranges and the differences in habitats would at first seem to place *L. d. nelsoni* as the least likely ancestor.

In general, we believe that the most closely related species are to be expected in adjacent rather than in the same or distant geographic areas (Jordan's rule). In the case of *L. zonata* there are two species (*pyromelana* and *doliata*) occurring near its present range. Although *pyromelana* is adjacent to *zonata* it is seemingly only distantly related. In *pyromelana*

the body proportions (shape of head, slenderness of body and length of tail), greater number of teeth, and the white snout are peculiar to it alone. Many similarities and some convergence of scale and color pattern (Tanner *op. cit.*) are present in *L. p. infralabialis,* however, there still remain the above basic differences separating *pyromelana* and the other two species, *doliata* and *zonata.* These differences seemingly reduce, if not eliminate, the possibility of *pyromelana* being ancestral to *zonata.*

The widely dispersed and divergent *L. doliata* is similar to *zonata* in color pattern, except for the expanding of the white rings on the lateral rows, in body proportions and in scutellation. We believe that *L. doliata* is closely related to *L. zonata,* and that an ancestral form similar to *d. nelsoni* or *d. taylori* probably represents the line from which *zonata* was derived. By suggesting that *doliata* is ancestral to *zonata* does not imply that we think they are conspecific. This remains to be demonstrated, by the discovery of intermediate populations.

Table 1. Interspecific Characteristics

	L. d. taylori	*L. p. infralabialis*	*L. z. multicinta*[1]	*L. d. nelsoni*[2]
No. of specimens	54	29	38	25
Ventrals (average)	185	223	216	214
(range)	175-198	213-230	202-227	200-224
Caudals	38-53	59-79	46-61	42-56
Scale Rows	21-(23)	23	(25)-23-(21)	21-(23)
No. of body annuli	24-40	34-47	23-48	12-21
Ventrals minus Total annuli	155.5	183	180	197
Color of snout	Black or Mottled, never white	White	Black	Light, never Black
Ratio of tail to total	.134-.161	.154-.189	.132-.161	.120-.150
	.147	.176	.145	.138

[1]Taken principally from Zweifel, 1952.
[2]Data for 12 specimens taken from Blanchard, 1921.

Literature Cited

ANDERSON, PAUL. 1947. Observations on the denning habits of the prairie rattlesnake, *Crotalus viridis viridis* (Rafinesque). Nat. Hist. Misc. Chicago Acad. Sci. no. 9:2.

BLANCHARD, F. N. 1920. Three new snakes of the genus *Lampropeltis.* Occ. Pap. Mus. Zool., Univ. Mich. 81:1–10.

———— 1920. A Synopsis of the king snakes: genus *Lampropeltis* Fitzinger. Occ. Pap. Mus. Zool., Univ. of Mich., 87:1–7.

———— 1921. A Revision of the king snakes: genus *Lampropeltis.* U. S. Nat. Mus. Bull., 114:vi+260.

CONANT, R. 1943. The milk snakes of the Atlantic Coastal Plain. Proc. New Eng. Zool. Club, 22:3–24.

COPE, E. D. 1875. Check-list of North American Batrachia and Reptilia. U. S. Nat. Mus. Bull. 1.

HARDY, ROSS. 1938. An annotated list of reptiles and amphibians of Carbon County Utah. Proc. Utah Acad. Sci., 15:99–102.

KENNICOTT, ROBERT. 1860. Proc. Acad. Nat. Sci. Philadelphia, 12:328–329.

KLAUBER, L. M. 1948. Some misapplications of the Linnaean names applied to American snakes. Copeia. 1948:1–14.

LOOMIS, R. B. and J. K. JONES, JR. 1949. The Red Milk Snake, *Lampropeltis doliata syspila* in Nebraska. Copeia, 1949:295.

MITTLEMAN, M. B. 1952. Another interpretation of *Coluber doliatus* Linnaeus. Herpetologica, 8:22–25.

NELSON, D. J. 1948. *Lampropeltis triangulum gentilis* in Montana. Herpetologica, 4:170.

———— 1950. *Lampropeltis triangulum gentilis* in Montana. Herpetologica, 6:41.

RIDGWAY, ROBERT. 1912. Color standards and color nomenclature. Publ. by author, Washington: iv, 44p., 53 pl.

SCHMIDT, K. P. 1953. A check list of North American Amphibians and Reptiles. 6th Ed. Univ. Chicago Press pp. viii+280.

SMITH, H. M. 1942. Remarks on the Mexican king snakes of the *triangulum* group. Rochester Acad. Sci. 8:196–207.

———— 1952. Commentary on the identity of *Coluber doliatus*. Herpetologica, 8:26–27.

———— and E. H. TAYLOR. 1945. An annotated checklist and key to the snakes of Mexico. U. S. Nat. Mus. Bull. 187:iv+239.

STEJNEGER, L. 1903. The reptiles of the Huachuca Mountains, Arizona. Proc. U. S. Nat. Mus., 25:149–58.

TANNER, VASCO M. 1928. Distributional list of the amphibians and reptiles of Utah, No. 2. Copeia, No. 166:22–28.

TANNER, W. W. 1941. A study of the variation in the less common snakes of Utah. Great Basin Nat. 2:16–28.

———— 1951. *Lampropeltis doliata* rediscovered in Arizona. Herpetologica, 7:180.

———— 1953. A study of Taxonomy and Phylogeny of *Lampropeltis pyromelana* Cope, Great Basin Nat. 13:47–66.

YARROW, H. C. 1875. Report upon the collections of batrachians and reptiles: Rep. Geogr. Geol. Expl. Surv. W 100th Mer., 5:509–584.

ZWEIFEL, R. G. 1952. Pattern variation and evolution of the Mountain Kingsnake, *Lampropeltis zonata*, Copeia, 1952:152–168.