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A REVIEW OF THE COLUBRID SNAKE GENUS *CEMOPHORA* COPE

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Abstract

The monotypic genus *Cemophora* occurs throughout most of the southeastern United States, from southeastern Missouri, southern Illinois, and southern Indiana, southward to the Gulf of Mexico and eastward to the Atlantic coast as far north as New Jersey, excluding most of the Appalachian Mountain Chain; to the west the range extends to eastern Oklahoma and eastern Texas, with a population occurring in southern Texas separated by a hiatus of some 300 miles from the nearest eastern Texas locality. The genus is considered to be most closely related to *Lampropeltis*, especially the *Lampropeltis triangulum* group. The nomenclatural history of *Cemophora coccinea* is reviewed. An analysis of sexual dimorphism, ontogenetic variation, individual variation, and geographic variation is presented. Three subspecies may be distinguished on the basis of number of ventrals, supralabials, and pattern. The name *C. c. coccinea* is applied to the peninsular Florida population, *C. c. lineri* is the southern Texas race, and *C. c. copei* is used for the wide-ranging northern subspecies. It appears that the nominate race and *lineri* are closely related, suggesting a Pleistocene climatic condition that caused a split in the population and withdrawal into Texas and Florida (and adjacent areas) refugia. Later, as climatic conditions become favorable, the species reinhabited the southeast from Florida (and adjacent areas). The Suwanee Straits of northern Florida allowed the isolation necessary for the differentiation of *copei* from *coccinea*.

The scarlet snake was described as *Coluber coccineus* by Blumenbach (1788) from a Florida specimen. Gmelin (1789) repeated Blumenbach's description in the 13th edition of Linnaeus' *Systema Naturae*. Sowerby in 1804 described a specimen of a snake reportedly from Dumfrieshire, Scotland, as *Coluber dumfrisiensis*. Allocation of this name to the synonymy of *Cemophora coccinea* was made somewhat hesitatingly by Schmidt (1954). Merrem in 1820 treated *coccinea* under the genus *Elaps*. In 1837 Schlegel placed *coccinea* in the genus *Heterodon* on the basis of the enlarged maxillary teeth. Holbrook (1842) disagreed with Schlegel and placed it in the genus *Rhinostoma*. Duméril, Bibron, and Duméril (1854) placed *coccinea* in the genus *Simotes* (a junior synonym of a mammalian genus; apparently = *Oligodon*).

Cope (1860) considered the scarlet snake to be generically distinct and described a new genus, *Cemophora*, for it. He distinguished *Cemophora* from *Simotes* primarily on the basis of the form of the rostral scale. Unaware of Cope's work, Jan (1862) made the same distinction between the scarlet snake and the snakes of the genus *Simotes* and placed it in a new genus, *Stasiotes*. Cope's name has priority, however, hence the name stands as *Cemophora coccinea*.

Jan (1862) described *Cemophora copei* from Tennessee, based primarily on the fact that his specimen had the loreal entering the eye and had a greater number of body blotch-

es than typical *C. coccinea.* Garman (1884) considered *copei* a variety of *coccinea.* Cope (1900), however, placed *copei* in the synonymy of *coccinea,* where it has remained.

There has been much controversy in the last fifty years over the correct specific name for the scarlet snake (and, consequently, the specific name of the scarlet king snake). Stejneger (1918) was the first to comment on this problem, and suggested that the name *Coluber doliatus* Linnaeus, 1766, was not applicable to the scarlet king snake. He also pointed out the inapplicability of Schlegel's (1837) *Coronella coccineus* to either the scarlet snake or the scarlet king snake. *Coronella coccineus* probably is applicable to the same form described by Holbrook a year later as *Coluber elapsoides,* although Schlegel cited *Coluber coccineus* Latreille, 1802. Latreille, however, had reference to the scarlet snake *Coluber (=Cemophora) coccineus* of Blumenbach, 1788, and Schlegel's description makes it apparent that he was referring to the scarlet king snake *(Lampropeltis triangulum elapsoides).*

Klauber (1948), in contrast to Stejneger, felt that the name *Coluber doliatus* Linnaeus, 1766, could be correctly allocated and that it applied to the scarlet king snake and not to the scarlet snake. His beliefs were based on the fact that only two species in the Carolinas have both the ringed pattern and the ventral and caudal counts to satisfy Linnaeus' description. Since the original description also stated that the paired black rings do not quite surround the body, it could only apply to the scarlet king snake inasmuch as the scarlet snake has an immaculate venter.

Mittleman (1952) upheld Stejneger's disposition of the name *Coluber doliatus,* examining each of Klauber's main points in some detail, demonstrating that a different interpretation could be made, and that his (Mittleman's) interpretation would have the added advantage of retaining a well-established name. He demonstrated that there was little chance that a specimen of the scarlet king snake from the Carolinas would have 164 ventral scutes inasmuch as the highest numbers of ventrals in the scarlet king snake occur in the northern portion of the range and that out of a sample of 84 specimens of the scarlet king snake only three had 164 ventrals or less and these three were all from Florida. He also showed that a 164 count would be typical for *Cemophora* from the Carolinas. H. M. Smith (1952), in a short paper on the same subject, essentially agreed with Mittleman.

Smith, Lynch, and Puckette (1964 and 1965) took up the problem in an application to the International Commission on Nomenclature. They utilized data from ventral counts and information from the original description of *Coluber doliatus* by Linnaeus (1766), translated for them by a noted Linnaean scholar, Dr. Donald P. Rogers, Department of Botany, University of Illinois, and presented a convincing argument for placing the name *Coluber doliatus* Linnaeus, 1766, in the synonymy of *Cemophora coccinea.* They then requested that the name *doliatus* as used in the combination *Coluber doliatus* Linnaeus, 1766, be suppressed for the purposes of the Law of Priority. The basis for this is that the name *doliatus* has been too closely associated in the literature with the scarlet king snake. Although a decision on this problem is still pending, we are following the suggestions outlined by Smith, Lynch, and Puckette (op. cit.).

CEMOPHORA Cope, 1860

Cemophora Cope, 1860: 244.
Stasiotes Jan, 1862: 75 (type species, *Coluber coccineus* Blumenbach).

Type species.—*Coluber coccineus* Blumenbach, 1788.

Generic diagnosis.—A small to medium-sized snake with the rostral enlarged and projecting beyond the lower jaw, with the last two maxillary teeth distinctly enlarged and saber-like (Fig. 1), and with a dorsal

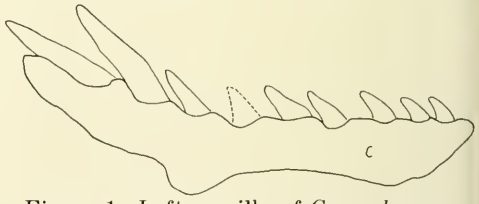

Figure 1. Left maxilla of *Cemophora coccinea,* showing enlarged posterior teeth.

pattern of red saddles bordered by black, between which are white or light yellow interspaces. The venter is immaculate; the snout is red. Pattern alone will separate this genus from all other North American genera with the possible exception of *Lampropeltis*

(some races of *L. triangulum*) from which *Cemophora coccinea* differs by having enlarged posterior maxillary teeth and the large rostral.

Description

Scutellation and size.—Rostral wider than high, strongly projecting, visible above for a distance equal to three-fourths the width of rostral. Rostral projecting between internasals for a distance equal to one-half the greatest length of internasals. Internasal suture equal in length to that of prefrontal suture, but internasals much smaller than prefrontals. Canthus rostralis rounded. Frontal almost hexagonal, almost as wide as long. Supraoculars small, their length equal to one-half the length of frontal. Eye distinctly visible from above. Parietals truncate to slightly rounded behind. Leng h of parietal suture almost one-half the length of frontal. Nasal scale divided; naris situated approximately in center of scale. Loreal single, small, about twice as long as high. Preoculars normally one. Postoculars normally 2, the lower somewhat smaller. Temporals usually 1 + 2. Supralabials usually 6 or 7; 2nd and 3rd supralabial entering the eye when the number is 6, the 3rd and 4th entering the eye when the number is 7. Infralabials usually 7, sometimes 6, 8, or 9. Three infralabials touching the anterior chin shields; 4th infralabial largest. Dorsal scales smooth, with two apical pits, usually in 19 rows throughout. Ventrals 149 to 195 (mean 168.9, 236 counts). Subcaudals in two rows, 31 to 50 (mean 40.7, 235 counts). Anal scale single. Females ranging from 148-705 mm total length, males 152-823 mm. Tail length/total length ratio range: females 0.111 to 0.163, mean 0.138, 83 counts; males 0.126 to 0.180, mean 0.148, 99 counts.

Color.—Color pattern consists of a series of black-bordered, red to red-orange blotches on a light gray, cream, or white background. Red blotches number 12 to 28 on the body

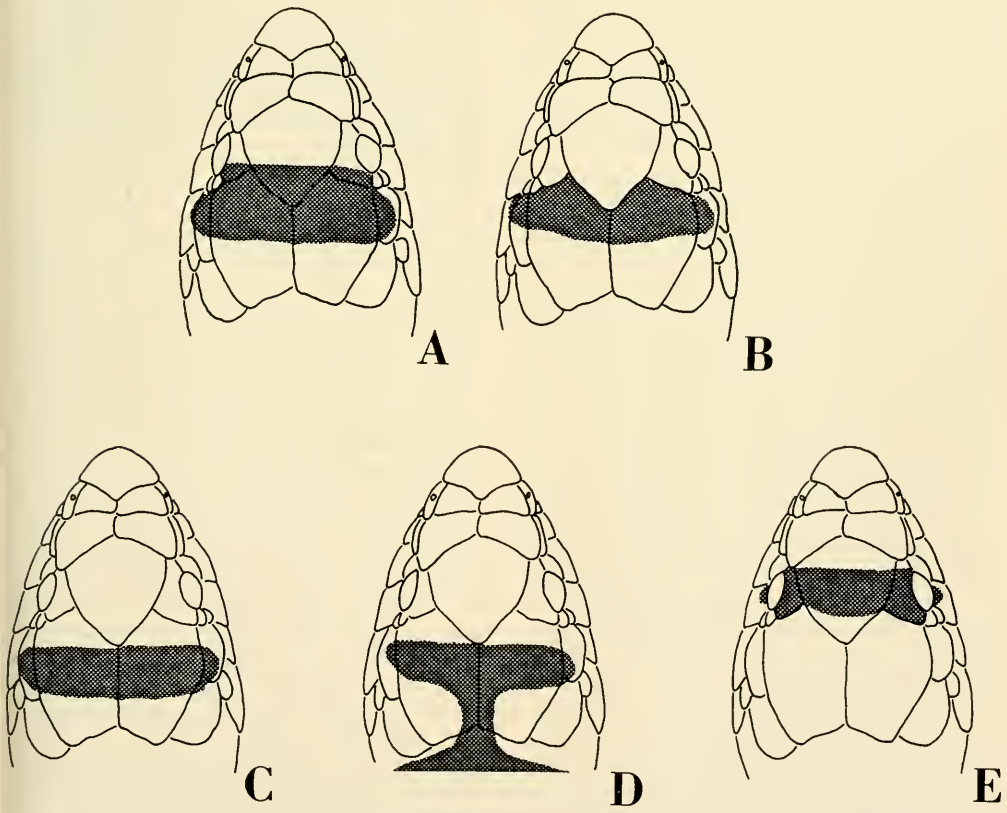

Figure 2. Diagrammatic representation of variation in head pattern of *Cemophora coccinea*. The most frequent pattern is represented by "A."

and 1 to 8 on the tail. Red blotches are usually longer than the black or white areas. The first red blotch ranges from 4½ to 12 scales in length and the fifth or sixth red blotch is from 1½ to 9 scales long. Both the first and the fifth or sixth white rings range from 1 to 4 scales in length. The venter is cream with an occasional slight invasion of the black rings into the lateral edges of the ventrals. The black band (Fig. 2) on the head varies in position from the middle of the frontal to the middle of the parietals; the rest of the head is red. This black band may be broken up or modified in any number of ways. The black band is followed by a white ring, then a black ring, and finally by the first red blotch. The lower portion of the side of the head is usually cream as is the chin.

Hemipenis.—This description was taken from an everted right structure (LSUMZ 7277). The hemipenis (Fig. 3) is bilobed with a single sulcus spermaticus extending onto the lateral lobe. The proximal area is naked. Distally a spinose area grades into a calyculate area that extends to the apices of the organ. Microornamentation of the calyces is papillate. The area between the lobes is naked. No apical differentiation occurs. Cope (1900, pl. 17, fig. 11) illustrates the *in situ* organ.

Osteology.—That *Cemophora* is a highly modified burrower is readily apparent from the anatomy of the skull. The overall appearance of the skull is one of smoothness. The premaxilla has a prominent anterior knob and is closely applied to the nasals, which are fused. The parietal shield is very weakly delimited. Both the prefrontals and postorbitals articulate with the maxillae. The quadrate is comparatively short and broad. Otherwise, the most interesting feature of the skull is the pair of enlarged posterior maxillary teeth on each side that are long, thin, and saber-like. Ranges in tooth counts are: maxilla 9-10 (6 counts), pterygoid 9-11 (4 counts; a fifth example having 3 teeth probably exhibits aberrant development), palatine 9-10 (4 counts), dentary 9 (6 counts).

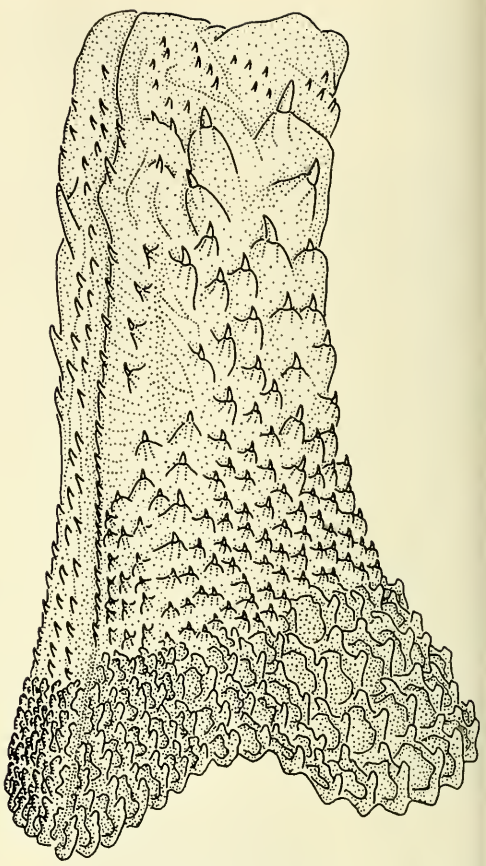

Figure 3. Sulcate view of right hemipenis of a *Cemophora coccinea* x *copei* intergrade (LSUMZ 7277) from 4 mi. WSW Otter Creek, Levy Co., Florida.

Individual Variation

Supralabials.—The number of supralabials varies from three to eight. Counting each side separately the following percentages of frequency were obtained: 6 (61.9), 7 (31.7), 5 (5.7), 8 (0.2), 4 (0.2), 3 (0.2). Considering both sides of the head the following combinations were observed: 6-6, 6-7, 7-7, 7-8, 5-6, 5-5, and 4-3. When the number of supralabials is 6, the 2nd and 3rd enter the orbit. When the number is 7, the 3rd and 4th enter the orbit. When the number is 5, the 2nd and 3rd enter the orbit, indicating that the point of reduction is behind the eye. In the one specimen (FMNH 22665) that has 8 supralabials on one side of the head, the 3rd and 4th enter the eye, indicating the addition is behind the eye. In the one specimen (MCZ 1344) with a supralabial count of 4-3, only the 2nd supralabial enters the eye. The significance of the high percentage of 6 and 7 supralabials will be discussed below.

Infralabials.—The number of infralabials

varies from 5 to 9. Counting each side separately the following percentages were obtained: 7 (57.1), 8 (27.3), 9 (9.9), 6 (5.4), 5 (0.2). Considering both sides of the head the following combinations were observed: 7-7, 9-9, 8-8, 7-8, 8-9, 6-7, 7-9, 6-8, 5-6, 6-6. When the number of infralabials is 6 or 7, the 4th is the largest, and three infralabials touch the anterior chin shields. When the number of infralabials is 8 or 9, the 5th is the largest, and usually 4 infralabials touch the anterior chin shields.

Loreal.—The loreal normally abuts against the lower portion of the preocular but occasionally protrudes beneath it and enters or nearly enters the orbit. There is no variation in the number of loreals, all counts being 1-1.

Preoculars.—Preoculars are invariably 1-1 with a single exception, that being 1-0.

Postoculars.—The number of postoculars is normally 2-2 (90.9) but there is some variation, as follows: 1-1 (6.6), 2-1 (1.4), and 3-2 (.95).

Dorsal scale rows.—There is considerable variation in the number of dorsal scale rows. The most common count is 19-19-19 (54.4). The following combinations also occur: 19-19-17 (14.6), 21-19-19 (12.1), 19-19-18 (5.1), 20-19-19 (1.9), 17-17-17 (1.9), 21-19-18 (1.3), 21-19-17 (1.3), 19-19-17 (1.3), 18-19-17 (1.3), 21-20-19 (0.07), 20-19-18 (0.07), 19-18-14 (0.07), 19-17-16 (0.07), 17-19-17 (0.07), 17-17-15 (0.07). Anterior counts were made one head length posterior to the first row of dorsal scales; middle counts were made approximately at mid-body; posterior counts were made just anterior to the anus.

Head pattern.—An attempt was made to categorize the variation of the black band on the head into several "basic types." We have designated five of these (Fig. 2). The most frequent type of head pattern (Fig. 2, A) is one in which the black band covers the posterior one-third of the frontal and anterior one-third to one-half of the parietal. The four remaining types are: (B) the black band is on the anterior one-third of the parietals and abuts against the posterior border of the frontal and supraoculars; (C) the black band crosses the middle of the parietal; (D) the black band of the head is joined with the first black band of the body; (E) the black band crosses the middle of the frontal and supraoculars. However, intermediate conditions between these types do occur and no two snakes have exactly the same head pattern.

The snout is normally red but occasionally scattered black pigment is present.

Albinism.—Brimley (1942) reported an albino specimen from between Reidsville and Leaksville, Rockingham County, North Carolina, with the comment that "It was about fifteen inches long and had the black bands replaced by white, the red spots reduced in size and the white (for black) and yellow ones widened."

Sexual Dimorphism

Sexual dimorphism occurs in number of ventrals, in tail length/total length ratios, and to a lesser extent in number of body blotches. Considering the entire geographic range of the species, females have a larger mean number of ventrals (170 3, 96 counts) than do males (165.8, 110 counts). Mean differences in caudal number is very slight, the means being 41.7 (111 counts) in males and 40.4 (94 counts) in females. Males have a proportionally longer tail (tail/total length = 0.148) than do females (0.138). Males also tend to have a higher number of body blotches (mean for males 18.3, 111 counts; for females 17.6, 101 counts). The only characteristic significant at the .05 level using the "t" test is the number of ventrals.

Ontogenetic Variation

Perhaps the most striking ontogenetic variation in *Cemophora* is the change in coloration. Neill's report (1950:62) of this phenomenon is quoted in full: "In the newly hatched *Cemophora* the back bears a row of scarlet saddles that extend downward on the sides to the second or third scale rows above the ventral plates. The saddles are bordered anteriorly and posteriorly with black, and are separated by clear white interspaces. The white of the venter extends upward on the sides to include one or two scale rows and is also continuous with the white of the dorsal interspaces. Extending the length of the body along the ventrolateral region is an irregular row of black flecks, which form narrow lateral borders to the red saddles, and which tend to form a black spot just above the ventrals at the level of each white interspace. The degree of ventrolateral flecking is subject to considerable individual variation.

"Specimens of about 12 inches length begin to show a faint yellowish suffusion in the vertebral portion of each transverse white marking. As the snake grows older the yellow intensifies and spreads laterally. The ventrolateral black flecking is reduced, while the transverse black bands extend farther down on the sides and on to the ventral plates. The red likewise extends laterally, and also becomes richer and deeper. The fully adult scarlet snake is marked with deep red transverse bands that extend upon the tips of ventrals, and these red bands are bordered with narrower black ones that encroach even farther upon the abdominal scutes. The black-bordered red bands are separated by bright yellow interspaces, the yellow fading into white in the ventrolateral region. Often, but not invariably, there is a black spot on each side, just above the ventrals, at the level of each yellow interspace. The adult scarlet snake, viewed even from the side, appears to be ringed with red, yellow, and black; this is not the case with young examples. In favorable ecological areas the herpetologist may collect a series of large adults that appear to differ from the more familiar (and smaller) specimens generally encountered elsewhere.

"In very old specimens there is a general darkening and dulling of the entire pattern, the red becoming dark red-brown, and the yellow becoming tan or even light gray-brown. The darkening begins in the vertebral region and progresses laterally with age."

Woolcott (1959: 263), mentioned that newly hatched *Cemophora* have, "soft pink colored saddles rather than the characteristic red."

Ecological and Life History Notes

Aside from a few miscellaneous notes on food and food habits, habitat, and activity, there is little information available on the ecology of *Cemophora*.

Food.—The data available in the literature have been placed in tabular form (Table 1). Small lizards and reptile eggs appear to form the bulk of the diet, with insects, small amphibians, and young mammals making up a lesser portion. No detailed stomach content studies have been undertaken in this species, but should prove worthwhile if enough material can be obtained.

Feeding on eggs may be correlated with the enlarged posterior maxillary teeth of *Cemophora* (Minton and Bechtel, 1958). Neill (1951), however, surmised that *Cemophora* may puncture eggs with its pointed snout.

TABLE 1.
Food records of *Cemophora coccinea*.

Type of Food	Reference
Probably worms and insect larvae	Minton, 1944
Small frogs, lizards, and insects	Haltom, 1931
Acris	Brode and Allison, 1958
Anole	Wilson, 1951
Small lizards and snakes	Brimley, 1942
Lygosoma, *Eumeces*, *Haldea*, young of *Diadophis*, and young of wild mice	Ditmars, 1936
Eggs of *Terrapene c. bauri*	Dickson, 1948
Eggs of *Elaphe g. guttata*	Minton and Bechtel, 1958
Eggs of *Graptemys* and *Pseudemys* (?)	Neill, 1951
Eggs of *Cemophora* (in captivity)	Ditmars, 1936
Hard orange or yellow substance in digestive tract (=solidified egg yolk?)	Palmer, *pers. comm.*

Habitat.—Scarlet snakes are fossorial or semifossorial snakes coming to the surface primarily at night. Specimens have been collected in leaf litter, rotten logs, in various types of soil, especially sandy soil, and under rocks.

With respect to macrohabitat, scarlet snakes have been collected in pine forest, hardwood forest, and in mixed forest.

Burrowing.—Wilson (1951: 172) discussed burrowing behavior of the scarlet snake. "Placed in a container with several inches of loose soil, the snake soon began burrowing movements, thrusting the head to right and left until the head and neck were concealed. The procedure then was altered, the snake forcing the snout deeper into the soil and lifting it upward. This continued until the snake was completely concealed. It remained several days in concealment before again emerging."

Distribution

Cemophora coccinea is mainly Austroriparian in distribution (Fig. 4), which fits Savage's (1960) map of the herpetological provinces of North America fairly well for this region. The main discrepancies are in

the Ohio Valley region where the scarlet snake ranges farther north than Savage's boundary and in the western portion of the range where the species extends into Savage's Desert and Plains Province in eastern Oklahoma.

The range of the scarlet snake extends along the Atlantic coast from New Jersey southward to the southern tip of Florida, westward including all the Gulf coast states at least as far as Kenedy County, Texas; the range extends northward including eastern Texas, eastern Oklahoma, Arkansas, Tennessee, and Kentucky to southern Indiana, southern Illinois, and southeastern Missouri. Records for the Florida Keys (Carr, 1940) were discounted by Duellman and Schwartz (1958).

Physiographically speaking, the scarlet snake is primarily found on the Coastal Plain (Fenneman, 1949). The range of *C. coccinea* extends onto the Piedmont and as far north as the Interior Low Plateau. The scarlet snake apparently is absent in the main portion of the Appalachian chain.

Auffenberg (1948: 212) was the first to report the scarlet snake in Texas. He stated, however, that "there is no doubt that these snakes were accidentally brought in from Pensacola, Florida." We have corresponded with Dr. Auffenberg, hoping to borrow the specimens and perhaps pin down more precisely the provenance of these specimens, but he reported that the specimens have apparently been discarded. It is likely that the

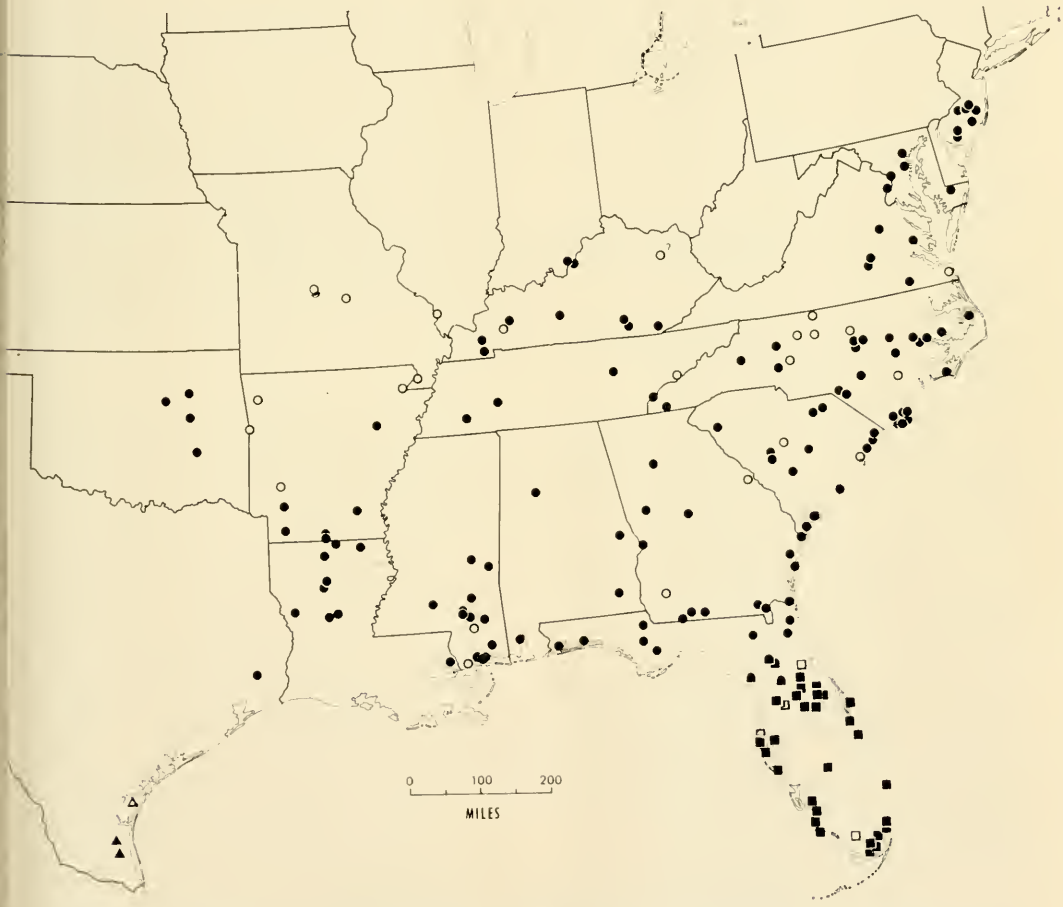

Figure 4. Distribution of *Cemophora coccinea* and subspecies. Squares represent *C. c. coccinea;* circles, *C. c. copei;* triangles, *C. c. lineri;* square-circle combination, *coccinea-copei* intergrades; open symbols, literature records.

specimens represented the southern Texas race.

C. coccinea has been recorded from central and southeastern Missouri (Anderson, 1965; Nickerson, in press). Anderson reported scarlet snakes from Dunklin and Phelps counties, although the Dunklin specimen is not available for confirmation. Nickerson reported three additional specimens from Miller and Camden counties.

A specimen of *C. coccinea* collected at Wolf Lake Swamp, Union County, Illinois (Bennett, 1953) represents the single record for that state. The specimen cannot now be found in the collections of Southern Illinois University, according to Dr. Ronald Brandon (pers. comm.). P. W. Smith (1961) accepted the record as valid.

Three specimens were reported from extreme southeastern Indiana, by Minton and Bechtel (1958) who drew attention to the interesting fauna found on the bare slopes at the southern end of the Knobstone Escarpment. This area is also the only portion of that state where *Tantilla c. coronata, Cnemidophorus sexlineatus,* and a large trap-door spider have been found.

Kentucky records have recently been reviewed by Fuller and Barbour (1962) and Collins (1964).

Records from the Delmarva Peninsula (Delaware, and the peninsular parts of Maryland and Virginia) have been summarized by Conant (1958).

Scarlet snakes apparently are widespread in Louisiana. Their actual abundance is uncertain; prior to the summer of 1966 only about twelve specimens were known from the state. However, during June, 1966, one of us (Williams) collected seven specimens in Natchitoches Parish, six in two nights, suggesting that the species may not be as rare as formerly thought.

The scarlet snake is not common anywhere in its range, but appears to reach its greatest abundance in Florida and North Carolina, where it is not infrequently encountered in some localities. Impressions of abundance, however, simply reflect availability of material.

Generic Relationships

The affinities of the scarlet snake, *Cemophora coccinea,* apparently are with a group of five North American genera (*Lampropeltis, Rhinocheilus, Stilosoma, Arizona,* and *Pituophis*), which all agree in being generalized colubrids of constricting habits and in having a long intrapulmonary bronchus (Underwood, 1966). The hemipenis in these genera, consists of a bilobed structure with a single *sulcus spermaticus* ending obliquely in one lobe, with apical calyces of variable extent, and with nonenlarged spines on the medial portion. The basal area typically is smooth or with small spinules. The genus *Cemophora* appears to be most closely related to *Lampropeltis* (Tables 2 and 3). It differs from that genus in having a more prominent rostral, enlarged posterior maxillary teeth, and a smaller number of maxillary teeth.

To show the generic relationships of *Cemophora,* we have attempted to set up a system similar to that set up by Norris (1958: 294) showing specific relationships within the lizard genus *Uma.* These data are presented in Tables 2 and 3. By this method the following relationships are shown, from the closest to the most distant: *Lampropeltis, Arizona* and *Rhinocheilus* (equally close), *Stilosoma,* and *Pituophis.* The genus *Stilosoma,* although exhibiting certain unique features, appears to be more closely related to *Cemophora* than to any of the other genera.

Cemophora coccinea most closely resembles certain members of the *Lampropeltis triangulum* group (particularly *L. triangulum syspila*) in terms of color pattern. It resembles *L. t. elapsoides* (= *L. doliata doliata* of many authors) most closely in development of the rostral plate, numbers of ventrals and caudals, numbers of supralabials and infralabials, and number of temporals. The scarlet snake differs from *L. t. elapsoides* in not having the rings of the dorsal pattern continued onto the venter. There is a possibility of convergence of the various characters involved between these species. In our present state of knowledge, however, it seems best to consider the genus *Cemophora* to be a derivative of some member of the *triangulum* group, which became adapted to a more fossorial existence and to a more specialized diet consisting in large part of the eggs of reptiles.

TABLE 2.
Comparison of Cemophora with related genera[1]

	Lampropeltis	*Rhinocheilus*	*Arizona*	*Pituophis*	*Stilosoma*	*Cemophora*
Ventrals	152–254	181–218	185–241	205–262	239–277	149–195
Subcaudals	27–79	41–61[2]	39–63	47–84	33–48	31–50
Supralabials	7–8	8(6–9)	8(7–9)	8–9(7–10)	6	6–7
Infralabials	9–10	9(8–11)	11–15	10–15	6–7(5–8)	7(6–9)
Internasals	2	2	2	2	2	2
Prefrontal	2	2	2	2–4	2	2
Nasal	divided	divided	semidivided	divided	single	divided
Loreal	0–1	1	1	0–1	none	1
Preocular	1	1–2	1(2)	1–2(3)	1(0)	1
Postocular	2	2	2(1)	2–4	2	2
Temporals	2+3+4	variable	2+3	variable	1+1	1+2
Anal plate	entire	entire	entire	entire	entire	entire
Dorsal Scales[3]	17–27(2)	23–25(1–2)	25–31(1)	27–37(2)	19(0)	19(2)
Total length/ tail ratio	0.09–0.18	0.12–0.17	0.11–0.17	0.10–0.19	0.07–0.10	0.11–0.18

[1] Data obtained from the following sources: *Lampropeltis* (Blanchard, 1921), *Rhinocheilus* (Klauber, 1941), *Arizona* (Klauber, 1946), *Pituophis* (Stull, 1940), *Stilosoma* (Highton, 1956).

[2] Most subcaudals undivided; in five other genera they are divided.

[3] All genera except *Pituophis* have smooth dorsal scales; number in parenthesis refers to number of apical pits. preceding figures refer to number of scale rows at midbody.

TABLE 3.
Relationships of the Lampropeltis-like Genera

	1 *Lampropeltis*	2 *Rhinocheilus*	3 *Arizona*	4 *Pituophis*	5 *Stilosoma*	6 *Cemophora*
Ventrals	2,3,6	1,3,6	1,2,6	5	4	1,2,3
Caudals (number)	2,3	1,3	1,2	–	6	5
Caudals (divided or not)	3,4,5,6	–	1,4,5,6	1,3,5,6	1,3,4,6	1,3,4,5
Supralabials	–	3	2	–	–	–
Infralabials	2	1	4	3	6	5
Interr asals	2,3,4,6	1,3,4,6	1,2,4,6	1,2,3,6	–	1,2,3,4
Prefrontals	2,3,6	1,3,6	1,2,6	–	–	1,2,3
Nasal	2,4,6	1,4,6	–	1,2,6	–	1,2,4
Loreal	4	3,6	2,6	1	–	2,3
Preocular	6	3,4	2,4	2,3	–	1
Postocular	2,3,5,6	1,3,5,6	1,2,5,6	–	1,2,3,6	1,2,3,5
Temporals	2,3	1,3	1,2	–	–	–
Anal plate	–	–	–	–	–	–
Dorsal scales	2,3,4	1,3,4	1,2,4	1,2,3,	6	5
Total length/ tail length ratio	2,3,4,6	1,3,4,6	1,2,4,6	1,2,3,6	–	1,2,3,4
Color pattern	6	5	4	3	2	1
Lampropeltis	–	10 62%	9 56%	6 38%	2 12%	9 56%
Rhinocheilus	10 62%	–	11 69	5 31	2 12	7 44
Arizona	9 56	11 69	–	7 44	2 12	7 44
Pituophis	6 38	5 31	7 44	–	2 12	5 31
Stilosoma	2 12	2 12	2 12	2 12	–	5 31
Cemophora	9 56	7 44	7 44	4 25	5 31	–

We have patterned this method of showing relationships after Norris (1958: 294). Each genus is assigned a number and by the use of these numbers, similarities of one or more genera to any one genus can be noted. A blank space generally reflects the lack of affinities with any of the other genera.

The lower portion of this table summarizes the above information. For example, *Cemophora* exhibits 9 characters out of 15 in common with, or a 58 per cent similarity to, *Lampropeltis* and links it most closely with that genus.

Discussion of Subspecies

Cemophora coccinea coccinea
(Blumenbach)
(Figure 5)

Coluber coccineus Blumenbach, 1788: 11; Gmelin *in* Linnaeus, 1788: 1097; Daudin, 1803: 43 (part); Harlan, 1827: 356 (part).
Elaps coccineus: Merrem, 1820: 145 (part).
Heterodon coccineus: Schlegel, 1837: 141 (part).
Rhinostoma coccineus: Holbrook, 1842: 125, pl. 30 (part); Baird and Girard, 1853: 118 (part).
Rhinostoma coccinea: Baird, 1859: pl. 33, fig. 89.
Simotes coccineus: Duméril, Bibron, and Duméril, 1854: 637; Günther, 1858: 26.
Stasiotes coccineus: Jan, 1862: 75 (by inference; part).
Cemophora coccinea: Cope, 1860: 244 (part); Jan, 1863a: 45 (part); Garman, 1884: 78 (part); Cope, 1888: 381 (part); Cope, 1892: 602 (part); Boulenger, 1894: 214 (part); Cope, 1900: 928 (part); Brown, 1901: 85 (part); Duellman and Schwartz, 1958: 306.
Cemophora doliata coccinea: Mittleman, 1952: 25.
Cemophora doliata: H. M. Smith, 1952: 26 (part).
Cemophora coccinea coccinea: Williams, Brown, and Wilson, 1966: 85 (part).

Holotype.—Apparently nonexistent. Type locality, "Florida."

Range.—The Florida peninsula south of approximately 29°5′ degrees of latitude.

Diagnosis.—A subspecies of *Cemophora coccinea* usually with 7 supralabials (91 percent have at least 7 on one side), with 4th and 5th supralabials entering orbit; ventrals 158-185, mean 174.0 (69.9 percent have 170 or more); body blotches 12-22, mean 17.6; black bands of dorsal pattern extending laterally to dorsal scale rows 1 or 2, and enclosing dorsal red blotches; black band of first body blotch not touching parietals (85.5 percent separated by 2 or more scales).

Variation.—Supralabials 6-8, mean 6.9 (118 counts). Ventrals 158-185, mean 174.0

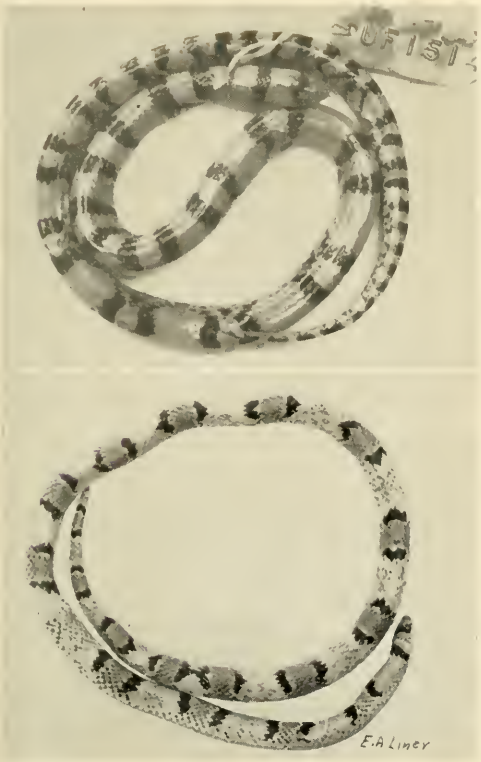

Figure 5. Upper, *Cemophora coccinea coccinea* from Tampa, Hillsborough County, Florida (UF 1514). Photograph by J. Harvey Roberts. Lower, *C. c. lineri* from 34.5 miles S Riviera, Kenedy County, Texas (AMNH 75307), photograph by Gerald C. Schaefer.

(59 counts); subcaudals 36-50, mean 42.7 (61 counts). Body blotches 12-22, mean 17.6 (61 counts). In *C. c. coccinea* populations first black band on body never touching parietals, separated from parietals by 1-4 scales, means 2.3 (62 counts).

Remarks.—Duellman and Schwartz (1958: 306) mentioned that the number of body blotches in *Cemophora coccinea* in peninsular Florida decreases from north to south. Our data tend to support their contention, although the cline is not so clear-cut. Eighteen specimens from Alachua and Marion Counties (here considered as intergrades between *C. c. coccinea* and *C. c. copei*) have 10 to 25 dorsal blotches, mean 18.3. Fourteen specimens from Lake and Pinellas Counties have 16 to 22 dorsal blotches, mean 18.1. Twelve specimens from Dade and Collier Counties have 12 to 21 dorsal blotches, mean 16.2.

That the peninsular Florida animals might be distinct from the mainland form has been suggested by Neill (1950) and Mittleman (1952). Neill pointed out the low number of dorsal body blotches (discussed above) in southern Florida (Dade County) and the high number in Georgia (our data for 18 specimens show a mean of 18.4 for this state). He also mentioned some difference in head pattern, Georgia specimens having a straight black head band and southern Florida specimens having a black band in the form of a wide V, with the apex directed backwards. We have, however, found this character to be highly variable and of little geographic significance.

Cemophora coccinea copei Jan

(Figure 6)

Coluber coccineus Daudin, 1803: 43 (part); Harlan, 1827: 356 (part).

?*Coluber dumfrisiensis* Sowerby, 1804: 5, pl. 3 (here considered a *nomen dubium*).

Elaps coccineus: Merrem, 1820: 145 (part).

Heterodon coccineus: Schlegel, 1837: 102 (part).

Rhinostoma coccineus: Holbrook, 1842: 125 (part); Baird and Girard, 1853: 118.

Rhinostoma coccinea: Baird, 1859: pl. 33, fig. 89.

Simotes coccineus: Duméril, Bibron, and Duméril, 1854: 637 (part); Günther, 1858: 26 (part).

Cemophora coccinea: Cope, 1860: 244; Jan, 1863b: 230; Jan, 1863a: 45 (part); Bocourt, 1883: 567; Garman, 1884: 78 (part); Cope, 1888: 381 (part); Cope, 1892: 602 (part); Boulenger, 1894: 214 (part); Cope, 1900: 928 (part); Brown, 1901: 85 (part); Stejneger, 1918: 99 (part).

Stasiotes coccineus: Jan, 1862: 75 (by inference; part).

Cemophora copei Jan, 1863b: 231; Jan, 1863a: 45.

Cemophora coccinea var. *copei:* Garman, 1884: 78.

Cemophora doliata doliata: Mittleman, 1952: 25.

Cemophora doliata: H. M. Smith, 1952: 26 (part); P. Smith, 1961: 223.

Holotype.—Presumably in the Geneva Museum, if designated. Type locality, "Tennessee."

Range.—New Jersey, southern Indiana, southwestern Illinois, and southeastern Missouri southward to the Gulf coast, including northern Florida, westward to eastern Texas. The scarlet snake apparently does not pene-

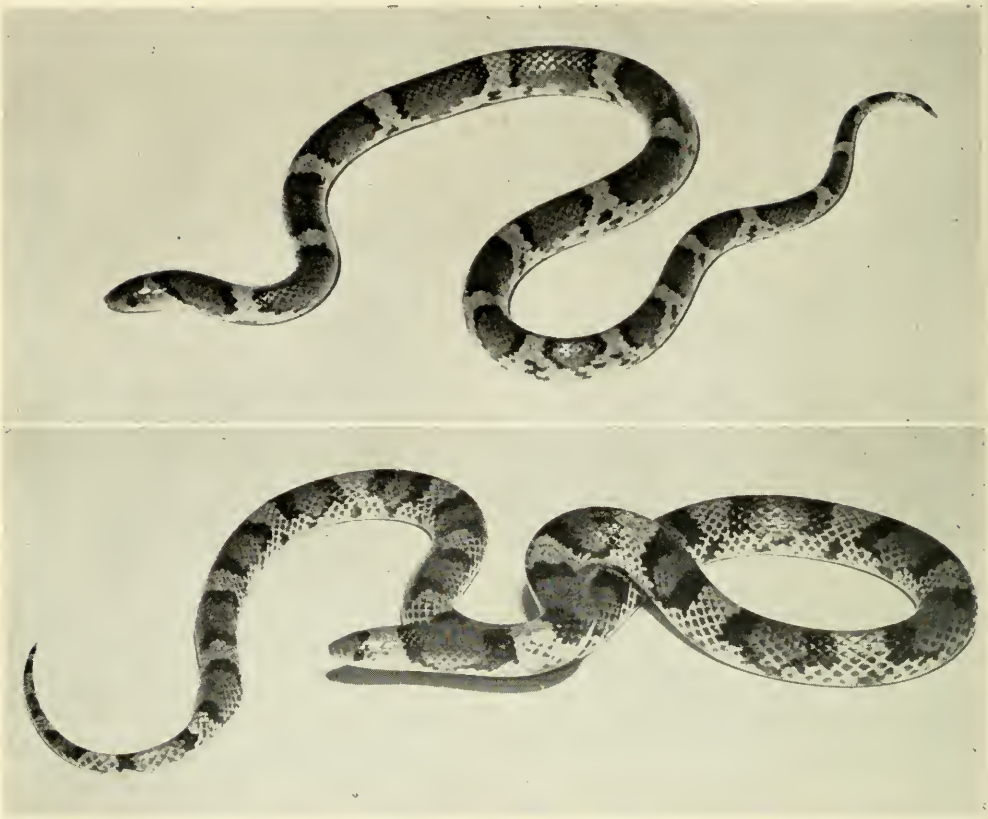

Figure 6. Upper, *Cemophora coccinea copei* from Lake Pine, Burlington County, New Jersey (AMNH 96127), showing juvenile pattern. Lower, *C. c. copei* from Blountstown, Calhoun County, Florida. Both photographs by Isabelle Hunt Conant.

trate far into the Appalachian Mountain chain.

Diagnosis.—A subspecies of *Cemophora coccinea* usually with 6 supralabials (82.4 percent have at least 6 on one side while lacking 7), the 3rd and 4th supralabials entering orbit; ventrals 150-180, mean 165.3 (70 percent 169 or less); body blotches 13-28, mean 18.6; black bands of dorsal pattern extending laterally to dorsal scale rows 1 or 2, and enclosing dorsal red blotches; black band of first body blotch usually touching parietals in 88 specimens, joining or approaching junction with black band of head in 77 specimens (85.1 percent touching, joined or separated from parietal by one or less scales).

Variation.—The subspecies *C. c. copei* exhibits considerable variation, some of which is of geographic interest (Table 4) and is discussed below.

Ventrals range from 150-180, mean 165.3 (180 counts), increasing clinally from north to south along the coastal plain. The means range from a low of 158.6 in New Jersey to a high of 170.0 in northern Florida. The mean number of ventrals remains approximately the same as that of northern Florida in those states bordering the Gulf of Mexico. The high ventral number in the peninsular Florida population apparently represents a southward extension of this cline. Inland there is a slight increase in ventral number from southwest (Oklahoma and Arkansas) to northeast (Indiana and Kentucky).

Caudals range from 30-48, mean 39.5 (161 counts). No clinal differences in the number of caudals comparable to those found in number of ventrals are apparent, the mean numbers for the states involved exhibiting a rather erratic pattern.

TABLE 4.
Geographic variation in C. c. copei. N = number of counts, R = range, X = means, T = first body blotch touching parietal, J = first body blotch joined with dark head band, NT = first body blotch not touching parietal.

Locality	Ventrals			Subcaudals			Supralabials			Body blotches			First body blotch		
	N	R	X	N	R	X	N	R	X	N	R	X	T	J	NT
New Jersey	16	153–162	156.9	16	35–43	38.3	31	5–7	5.9	17	14–19	16.0	11	0	6
Maryland	3	150–170	160.3	2	38–40	39.0	4	6	6.0	3	14–18	16.0	2	1	0
Washington, D. C.	1	161	161.0	1	41	41.0	2	5–6	5.5	1	15	15.0	1	0	0
Virginia	5	162–167	163.6	6	34–42	37.8	10	6	6.0	5	16–20	17.8	4	1	0
North Carolina	48	154–172	161.2	51	32–46	39.4	81	3–7	5.9	54	13–20	17.0	36	2	5
South Carolina	18	157–178	165.3	18	34–44	40.2	35	5–6	5.9	19	14–20	17.2	12	3	3
Georgia	17	154–174	166.3	17	38–48	41.8	40	5–7	6.0	18	14–22	18.4	12	3	4
Northern Florida	9	159–176	170.0	9	36–45	39.9	17	5–7	6.1	9	14–19	17.4	1	1	6
Alabama	6	162–171	167.8	6	36–40	38.5	12	5–6	5.8	6	15–20	18.2	1	3	2
Mississippi	15	161–177	170.0	12	33–46	40.7	30	5–7	6.2	16	16–21	18.7	0	4	1
Louisiana	10	161–184	170.2	10	35–42	38.3	19	5–7	6.1	11	16–27	23.4	1	3	7
Eastern Texas	1	174	174.0	1	43	43.0	2	6	6.0	1	25	25.0	0	0	1
Arkansas	6	156–176	161.0	6	36–40	37.7	12	6–7	6.1	6	18–27	22.5	2	1	3
Oklahoma	7	156–176	164.4	6	34–43	38.0	10	6–7	6.4	7	18–28	22.4	0	4	3
Missouri	1	149	149.0	1	40	40.0	2	6	6.0	1	19	19.0	0	0	0
Illinois	1	161	161.0	1	41	41.0	2	6	6.0	1	19?	19.0?	0	0	0
Indiana	3	163–168	165.0	2	33–40	36.5	6	6	6.0	3	19–22	20.3	1	2	0
Kentucky	9	161–180	167.5	6	36–40	37.8	17	5–7	5.8	9	15–23	19.4	1	3	2
Tennessee	4	155–171	163.8	4	38–41	39.8	8	6–7	6.1	4	17–23	20.0	1	3	0

Supralabials usually number 6 (74.8 percent have 6 on both sides, an additional 7.6 percent have 6 on one side and 7 on the other; 7.6 percent have 6-5, the remaining 10 percent are either 5-5, 7-7, or 4-3). Supralabials range from 3-7, mean 5.9 (340 counts). There is a tendency for a greater number of specimens to have 5 supralabials in the coastal area rather than the inland area, but this apparently lacks significance.

The number of body blotches ranges from 13-28, mean 18.6 (191 counts). There is a distinct difference in the mean number of body blotches between the inland and coastal states (including only that part of Louisiana east of the Mississippi River). The range in number of body blotches for the coastal area is 13-22, mean 17.5. The range in number of body blotches for the inland area is 15-28, mean 21.8. There appears to be a clinal increase in number of body blotches from north to south within the coastal area. The discrepancies in this cline may be due to lack of specimens. The cline reverses itself in peninsular Florida (see discussion of variation in *C. c. coccinea*). There is some indication that there is a clinal increase in number of body blotches from northeast (Indiana and Kentucky) to southwest (Oklahoma, Arkansas, and Louisiana west of the Mississippi River). This is uncertain, however, and these differences may instead be indicative of a difference between the inland states east of the Mississippi River (Illinois, Indiana, Kentucky, and Tennessee) and those west (Arkansas, Oklahoma, Louisiana, and extreme eastern Texas).

In the Atlantic coastal states the first black body band usually touches the parietals. The position of the first black body band becomes highly variable in the Gulf coastal states and the inland area. It may either touch (53.8 percent) or be separated from the parietals (23.4) or joined with the black head band (22.8). The number of dorsal scales separating the first black band from the parietals usually is 1 or 2 (range 1 to 3, mean 1.5) in this area, whereas in the peninsular Florida population it is usually 2 or 3 or more (see discussion of *C. c. coccinea*).

Cemophora coccinea lineri Williams, Brown, and Wilson

(Figure 5)

?*Cemophora coccinea* Auffenberg, 1948: 212.

Cemophora coccinea lineri Williams, Brown, and Wilson, 1966: 85.

Holotype.—AMNH No. 75307, collected 34.5 miles S. Riviera, Kennedy County, Texas, on 29 June 1963 by Ernest A. Liner and Richard Whitten.

Range.—Known only from Kenedy County, Texas.

Diagnosis.—A subspecies of *Cemophora coccinea* with 7 supralabials (100 percent in known specimens), the 4th and 5th supralabials entering orbit; ventrals 188-195, mean 191.5; body blotches 17; black bands of dorsal pattern extending laterally to dorsal scale rows 3, 4, or 5, and not enclosing dorsal red blotches; black band of first body blotch not touching parietals.

Variation.—Little is known of variation in this subspecies, only two specimens being available for examination.

Remarks.—As stated in the original description (Williams, Brown, and Wilson, 1966: 85) we believe that *Cemophora coccinea* is a natural resident in the area around Corpus Christi, Texas. It is unfortunate that the specimens reported by Auffenberg (1948) were lost inasmuch as they might represent *C. c. lineri* or perhaps intergrades between *C. c. lineri* and the population to the north. Additional specimens from this area are much needed.

Intergradation Between Subspecies

Nineteen specimens from Levy, Alachua, and Marion Counties, Florida are considered to be intergrades between *Cemophora c. coccinea* and *C. c. copei*. Comparative data for *C. c. coccinea, coccinea-copei* intergrades, and *C. c. copei* are presented in Table 5.

The intergrades show strong tendencies toward *coccinea,* especially in ventrals and caudal counts. The number of body blotches shows influence of *copei* both in mean and in upper range. The mean number of supralabials is close to *coccinea;* however the occurrence of 6 supralabials on both sides occurs in 21 per cent of the intergrade populations (18 counts) and only 9 percent of *coccinea* (59 counts), while in *copei* 74.8 percent have 6 on both sides (130 counts).

Head pattern in the intergrades is obviously closer to *coccinea* since 95 percent do not have the first blotch touching the parietal (100% in *coccinea*).

No intergrades are known between *C. c. copei* and *C. c. lineri.*

Subspecific Comparisons and Relationships

As noted in the description of *Cemophora coccinea lineri* (Williams, Brown, and Wilson, 1966) there appears to be a close relationship between the south Texas race, *lineri* and the nominate subspecies, which occurs in peninsular Florida. Similarities are reflected in number of supralabials (normally 7 in both), in number of ventrals (both have distinctly higher means than *C. c. copei,* the higher mean occurring in *lineri*), and in low number of body blotches (the Atlantic coast population of *copei* agrees with them in this feature. *C. c. copei* appears to be more closely related to the nominate race than to *lineri,* as reflected by its mean number of ventrals and its possession of laterally complete body blotches (not closed laterally in *lineri*). The nominate subspecies may be separated from *C. c. copei* by the following characteristics: supralabials normally 7, as opposed to 6; a larger number of ventrals (mean for *coccinea* 174.0, for *copei* 165.3); and first body blotch separated from parietal by 2 or 3 scale lengths, whereas in *copei* the first body blotch usually in contact with parietal or, if not, separated from it by less than 2 scale lengths.

The similarity between the nominate form and *C. c. lineri* suggests a Pleistocene withdrawal of the species into eastern and western refugia. Additional examples of this phenomenon were given by Blair (1958). With the re-establishment of favorable conditions for this species there was a reinvasion of the southern United States from the Florida refugia. Differentiation of the mainland subspecies was probably aided by the opening of the Suwannee Straits (see Neill, 1957, for influence of the Suwannee Straits on the Florida fauna). The possibility that *lineri* represents a Gulf circumferential migrant from Florida is a distinct possibility (see Auffenberg and Milstead, 1965, for more details on this Pleistocene route).

Key to Subspecies of Cemophora coccinea

1. Ventrals 188 or more; body blotches not closed laterally ..... *Cemophora coccinea lineri*
1. Ventrals 185 or less; body blotches closed laterally 2
2. Supralabials normally seven, first black body blotch not touching parietals ..... *Cemophora coccinea coccinea*
2. Supralabials normally six, first black body blotch usually touching parietals or joined with black head band ..... *Cemophora coccinea copei*

Specimen List

The following is a list of the abbreviations used in this study for collections from which we examined specimens: AMNH American Museum of Natural History, New York;

TABLE 5.
Comparison of intergrades (coccinea x copei) with C. c. coccinea and C. c. copei

	coccinea	intergrades	*copei*
Ventrals	174.0(59)[1] (158–185)	175.2(19) (160–179)	165.3(180) (150–180)
Caudals	42.7(61) (36–50)	43.0(19) (37–47)	39.5(161) (30–48)
Supralabials	6.9(118) (6–8)	6.7(37) (6–8)	5.9(340) (6–7)
Body blotches	17.6(61) (12–22)	18.3(19) (15–25)	18.6(191) (13–28)
First black body band percent not touching parietal	100% (62) (2.3)[2]	95% (19) (2.3)	23.4% (163) (1.5)

[1] Means are followed by sample number in parenthesis; number in parenthesis below is sample range.

[2] Figure in parenthesis (below) for the last character is mean number of scale rows separating anterior edge of first black band from parietal.

BCB Bryce C. Brown personal collection, Baylor University, Waco, Texas; CNHM Chicago Natural History Museum, Chicago, Illinois; EEB Elmer E. Brown personal collection, Davidson College, Davidson, North Carolina; GCS Gerald C. Schaefer personal collection, University of Richmond, Richmond, Virginia; CU Cornell University, Ithaca, New York; JTC Joseph T. Collins personal collection, 5807 Montgomery Road, Cincinnati, Ohio; KLW Kenneth L. Williams personal collection (to be deposited in the Northwestern Louisiana State College collection, Natchitoches, Louisiana); KU University of Kansas Museum of Natural History, Lawrence, Kansas; LSUMZ Louisiana State University Museum of Zoology, Baton Rouge; MCNP Mammoth Cave National Park, Mammoth Cave, Kentucky; MCZ Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts; MSC Mississippi State University, State College; NCSM North Carolina State Museum, Raleigh; NM Newark Museum, Newark, New Jersey; RB Roger Barbour personal collection, University of Kentucky, Lexington; SAM Sherman A. Minton, Jr. personal collection, Indiana University Medical Center, Indianapolis; TCF Tom C. Fuller personal collection, 1247 S. Floyd St., Louisville, Kentucky; TU Tulane University, New Orleans, Louisiana; UCM University of Colorado Museum, Boulder; UF University of Florida, Gainesville; UIMNH University of Illinois Museum of Natural History, Urbana; UMMZ University of Michigan Museum of Zoology, Ann Arbor; UO University of Oklahoma, Norman; USM University of Southern Mississippi, Hattiesburg; USNM United States National Museum, Washington, D.C.; USWL University of Southwestern Louisiana, Lafayette; UT University of Texas, Austin.

Cemophora coccinea coccinea (specimens examined). **FLORIDA.** *Brevard County:* Cape Canaveral, AMNH 8442-8443; Eau Gallie, MCZ 7026. *Citrus County:* Floral City, CU 5403; 0.7 mi. E Inverness, UMMZ 109357. *Collier County:* Marco Island, UMMZ 109356; 3 mi. SE Naples, UF 8600. *Dade County:* 18 mi. W Florida City, UMMZ 108343; 7 mi. N Homestead, UMMZ 111363; Lemon City, USNM 26304, 30947-30948, 38161; Miami, UIMNH 37447; Ojus, USNM 25265; Paradise Key, USNM 85320-85321; Royal Palm State Park, Everglades, UIMNH 34664. *Hillborough County:* Tampa, CNHM 427, UF 1514. *Indian River County:* Sebastian, MCZ 16160, 38579, 43845. *Lake County:* Astor Park, UCM 18915-18917; 3 mi. W Astor Park, UF 4580; Eustis, CU 1732, USNM 24355, 24359; Leesburg, UMMZ 77468; Umatilla, UF 84; 3 mi. W Umatilla, UF 304. *Lee County:* Bonita Springs, CU 5653-5654; near Fort Myers, USNM 36962-36963. *Highlands County:* Lake Placid, Archibald Station, AMNH 65410. *Orange County:* No other data, USNM 56430; Oakland, UF 5937; Orlando, SAM 780, USNM 84885; near Orlando, USNM 124140. *Palm Beach County:* Palm Beach, MCZ 13656-13657. *Pinellas County:* Clearwater, USNM 10741; Gulfport, CNHM 8571-8572; Maximo Point, St. Petersburg, CU 956, UMMZ 79920. *Sarasota County:* 4 mi. E Sarasota, SAM 198. *Seminole County:* 8.5 mi. NE Geneva, UF 4579; 12 mi. E Sanford, UF 7060. *Volusia County:* 6 mi. E De Land, UF 7061; 1 mi. S. Lake Helen, UF 4582; 5.5 mi. E Ostean, UF 4576-4577. *No county data* (localities not mapped): Citronville, MCZ 6368; Eureka, CU 1299; Fairchild Gardens, UMMZ 118518; Georgiana, USNM 14828; Port Jackson, CU 2604.

Specimens not examined (plotted on map as open symbols). **FLORIDA.** *Brevard County:* Micco (Ditmars, 1936). *Dade County:* Coral Gables (Duellman and Schwartz, 1958); Fort Biscayne (Duellman and Schwartz, 1958). *Lake County:* Okahumpka (Neill, 1951). *Monroe County:* Pinecrest (Duellman and Schwartz, 1958). *Pinellas County:* Tarpon Springs (Brimley, 1910). *Putnam County:* Crescent City (Neill, 1951). *Sumter County:* Only data (Carr, 1940).

Cemophora coccinea copei (specimens examined). **ALABAMA.** *Dale County:* Ozark, CU 4050. *Lee County:* near Auburn, UMMZ 83196. *Mobile County:* Mobile, MCZ 56. *Walker County:* No other data, TU 17145. *No specific data* (not mapped): "north Alabama," USNM 5221. **ARKANSAS.** *Drew County:* Monticello, CNHM 40767. *Greene County:* 3.5 mi. SE Paragould, UMMZ 78182. *Hempstead County:* No other data, UMMZ 84171. *Lafayette County:* No other data, CNHM 21986-21987. *Union County:* near Louisiana-

Arkansas border, UMMZ 95920; 3 mi. S Eldorado, TU 18023. **FLORIDA.** *Calhoun County:* 6 mi. W Blountstown, UF 9666. *Clay County:* Orange Park, KU 60973-60974. *Columbia County:* Watertown, AMNH 8255. *Duval County:* Arlington, AMNH 22396. *Escambia County:* Pensacola, UMMZ 51762; vicinity of Pensacola, CNHM 53677-53678. *Jackson County:* 3 mi. SE Marianna, UMMZ 73939. *Liberty County:* near Wilma Ranger Station, LSUMZ 6173. *Okaloosa County:* 10 mi. SW Niceville, TU 13433. **GEORGIA.** *Bibb County:* near Macon, GCS 609. *Brooks County:* 5 mi. W Quitman, UMMZ 81177. *Camden County:* St. Mary's USNM 16701. *Charlton County:* Cheeser Island, Okefinokee Swamp, CU 354-355; Billy's Island, Okefinokee Swamp, CU 120, 6102. *Chatham County:* Savannah, CU 3920. *Chattahoochee County:* Fort Benning, CU 4669, 4754-4755. UIMNH 34266. *Fulton County:* Rosswell, MCZ 260. *Grady County:* Beechton, "the Hall," CNHM 8121. *Liberty County:* Riceboro, USNM 131709. *McIntosh County:* middle of Sapelo Island, KU 69906. *Meriweather County:* outskirts of Greenville, UMMZ 98041. *Thomas County:* Thomasville, CNHM 35449; Greenwood Plantation, Thomasville, CNHM 35980. **INDIANA.** *Floyd County:* 3.5 mi. W New Albany, SAM 8; 5 mi. W New Albany, SAM 520; Bald Knob, 5.5 mi. N New Albany, UMMZ 117522. **KENTUCKY.** *Bell County:* Pine Mountain State Park, TCF 193. *Calloway County:* Blood River at route 121 crossing, UIMNH 64658. *Edmonson County:* near Turnhole, Mammoth Cave National Park, MCNP 46. *Hopkins County:* 5 mi. W Mortons Gap, RB collection. *Jefferson County:* Mt. Holly near Harrison Lane south of Fairdale, TCF 192. *McCreary County:* 7 mi. W Cumberland Falls, JTC 282, 329. *Marshall County:* camp grounds, Camp Bear Creek, TCF 188. *Pulaski County:* 1.5 mi. S Burnside, TCF 166. **LOUISIANA.** *Grant Parish:* 10 mi. S Colfax, TU 5532, 11797; Fishville, USWL collection; near Pollock, TU 6383. *Jackson Parish:* 5.5 mi. E Jonesboro at Beech Springs, UCM 18631. *Lincoln Parish:* Dubach, TU 13264. *Morehouse Parish:* Prairie Mer Rouge, USNM 2185 (2). *Natchitoches Parish:* 3.2 mi. N Bellwood, KLW 2525; 6 mi. N Bellwood, KLW 2513; 7.7 mi. N Bellwood, KLW 2509; 7.3 mi. S Bellwood, KLW 2510; 8.2 mi. S Bellwood, KLW 2494; 0.3 mi. N Kisatchie, KLW 2511; 2.6 mi. SW Natchitoches, KLW 2474. *Sabine Parish:* Fort Jesssup, USNM 6298. *St. Tammany Parish:* 0.5 mi. N Hickory, LSU 14138. *Union Parish:* Oakland, TU 12994, 13477. **MARYLAND.** *Anne Arundel County:* Mill Creek, USNM 141395. *Baltimore County:* Baltimore, MCZ 750. *Wicomico County:* Salisbury, AMNH 77104. **MISSISSIPPI.** *Forrest County:* 18.5 mi. S Collins, UIMNH 29118; Hattiesburg, 2 mi. S on 28th Avenue, USM 55.237. *Harrison County:* Biloxi, CNHM 21556; near Bixoli, AMNH 46749; 4 mi. E Gulfport, LSUMZ 282; Handsboro, AMNH 78998; Mississippi City, USM 53.1087. *Jackson County:* Daisy-Vestery, near Red Creek Baptist Church, USM 57.434. *Jones County:* Laurel, MSC 1669-1671. *Lamar County:* near Hattiesburg, USM 55.236; 4.5 mi. NW Hattiesburg, USM 57.405. *Lauderdale County:* 8 mi. S Meridian, USM 53.1053. *Lawrence County:* Monticello, USNM 2189. *Newton County:* about 2 mi. N Decatur, MSC 2200. *Perry County:* Beaumont, USM 53.151. **NEW JERSEY.** *Atlantic County:* Albor's Blueberry Plantation, near Pleasant Mills, NM collection; Sweetwater, AMNH 96131. *Burlington County:* Green Bank, AMNH 96122; Mt. Misery, AMNH 69056; Fieldsboro Bridge, south of Mt. Misery, AMNH 96130; Ockanickon, south of Medford, AMNH 96123; Taunton Lakes, AMNH 96128-96129; near Taunton Lakes, AMNH 96124-96126; Taunton Lakes, near Lake Pine, AMNH 96127; intersection of route 70 and old Lakehurst road, east of Upton, AMNH 96121; Whitesburgh, AMNH 58070-58071; Woodmansie, 8 mi. SW Whiting, AMNH 96120. *Cumberland County:* north part of Millville, AMNH 96132; east part of Millville, AMNH 96133; Vineland, AMNH 63858. **NORTH CAROLINA.** *Beaufort County:* Belhaven, NCSM 704; Washington, CU 2205. *Brunswick County:* Oak Island, EEB 2168; Caswell Beach road, Oak Island, EEB 2175; Long Beach road on Oak Island, EEB 2169; near Southport on Long Beach road on Oak Island, EEB 2429; between Southport and Supply, Highway 130, EEB 2177-2178; intersection 130 and Long Beach road, Southport, EEB 2174; 6 mi. N Southport on North

Carolina route 303, EEB 2176; 13 mi. E Supply on North Carolina route 130, EEB 462; 16 mi. N Southport, NCSM 1735; 19 mi. N Southport, NCSM 1736; Wilmington, USNM 145608. *Burke County:* 8 mi. NW Morgantown on N. C. route 181, EEB 2268. *Carteret County:* Beaufort, MCZ 1344; Morehead City, NCSM 1024, 1026; between Morehead City and Newport on U. S. 70, EEB 474. *Clay County:* Hayesville, NCSM 706. *Cumberland County:* Fayetteville, CNHM 135178, EEB 927, USNM 137574. *Dare County:* Roanoke Island, AMNH 38157. *Iredell County:* Harmony, NCSM 701. *Mecklenburg County:* Davidson EEB 475. *New Hanover County:* near Carolina Beach, NCSM 705, 1021; 7 mi. S Wilmington, LSUMZ 13598. *Pitt County:* 1 mi. NW Greenville, NCSM 1028; 6 mi. S Grimesland, NCSM 1025. *Robeson County:* Maxton, AMNH 65586. *Scotland County:* No other data, NCSM 703. *Wake County:* no other data, NCSM 699; Cary, NCSM 708; Garner, NCSM 1022; near Holly Springs, NCSM 1027; near Milbrook, NCSM 707; Raleigh, CU 4312, NCSM 700, 702. *Wayne County:* 1.5 mi. NW Seven Springs, NCSM 1261. *Wilson County:* Wilson, NCSM 1023. **OKLAHOMA.** *Creek County:* Drumright, USNM 125119. *Okmulgee County:* no other data, UO 399, 3630, 12161, 12279. *Pittsburg County:* no other data, UO 28342. *Tulsa County:* Tulsa, UMMZ 84442. **SOUTH CAROLINA.** *Aiken County:* 2 mi. N Wagoner on route 39, EEB 1194. *Anderson County:* no other data, USNM 2387. *Beaufort County:* Bluffton, MCZ 5613; Lady Island, MCZ 4426, 13066. *Charleston County:* Charleston, USNM 2307. *Chesterfield County:* McBee, EEB 1286; 1 mi. SW Patrick on U. S. 1, EEB 3014. *Horry County:* Highway 90 in eastern part of county, EEB 361; near Myrtle Beach, UMMZ 94165; 1 mi. West of jct. with U. S. 17 on S. C. 544, north of Murrem's Inlet, EEB 1287. *Lexington County:* Leesville, CNHM 65160; 5 mi. SE Leesville, UMMZ 84441; near Leesville, USNM 89393, 91398. *Orangeburg County:* Norway, USNM 31179. *Sumter County:* Manchester State Forest Headquarters, EEB 670; Manchester State Forest, east end of the Rosemary Tower road, EEB 3202; 2.7 mi. S Wedgefield on S. C. 261, EEB 3051. **TENNESSEE.** *Cumberland County:* 8 mi. W Crossville, UMMZ 84439. *Decatur County:* Perryville, KU 2473. *Hardeman County:* 11 mi. NE Bolivar, UMMZ 79214. *Monroe County:* 7.9 mi. E Tellico Plains, Cherokee National Forest, UF 10822. **TEXAS.** *Hardin County:* 2.1 mi. NW Loeb, UT 22492. **VIRGINIA.** *Amelia County:* Amelia courthouse, USNM 145823. *Fairfax County:* Mt. Vernon, UMMZ 56260. *Hanover County:* Beaverdam, USNM 129361. *King William County:* West Point, USNM 144530. *Nottoway County:* 4 mi. W. Burkesville, USNM 145824. *Southampton County:* 4 mi. NW Courtland, UF 14471. *No data:* "Virginia," MCZ 13063. **WASHINGTON, D. C.** Anacostia, USNM 35308.

Specimens not examined (plotted on map as open symbols). **ALABAMA.** *Dale County:* Ozark (Snyder, 1945). **ARKANSAS.** *Pike County:* no other data (Dowling, 1957); *Sebastian County:* Fort Smith (Dellinger and Black, 1938); *Washington County:* No other data (Dowling, 1957). **FLORIDA.** *Duval County:* Jacksonville (Deckert, 1918). **GEORGIA.** *Richmond County:* No other data (Neill, 1948). **ILLINOIS.** *Union County:* Wolf Lake Swamp (Bennett, 1953). **KENTUCKY.** *Caldwell County:* Pennyrile Forest State Park (Collins, 1964). *Laurel County:* No other data (Fuller and Barbour, 1962). *Rowan County:* Area near Morehead (Collins, 1964). **MISSISSIPPI.** *Forrest County:* Brooklyn (Cliburn, 1958). *Hancock County:* Bay Saint Louis (Brimley, 1910). **MISSOURI.** *Dunklin County:* Kennett (Anderson, 1965). *Phelps County:* near Rolla (Anderson, 1965). **NEW JERSEY.** *Burlington County:* Whitesbog (Kauffeld and Trapido, 1944). **NORTH CAROLINA.** *Duplin County:* No other data (Brimley, 1942). *Durham County:* No other data (Brimley, 1942). *Forsyth County:* No other data (Brimley, 1942). *Guilford County:* No other data (Brimley, 1942). *Rockingham County:* Between Reidsville and Leaksville (Brimley, 1942). *Rowan County:* No other data (Brimley, 1942). **OKLAHOMA.** *Creek County:* Parthenia Park (Force, 1930). *Pittsburg County:* Just off route 6 near McAlester (Carpenter, 1954). **SOUTH CAROLINA.** *Georgetown County:* Georgetown (Jobson, 1940). *Richland County:* Columbia (Corrington, 1929). **TENNESSEE.** *Sevier County:* Cades Cove (King, 1939). **VIR-**

GINIA. *Princess Anne County:* No other data (Werler and McCallion, 1951).

Cemophora coccinea lineri (specimens examined). TEXAS. *Kenedy County:* King Ranch, BCB 10993; 34.5 mi. S Riviera (holotype), AMNH 75307.

Specimens not examined (plotted on map as open symbols). TEXAS. *Nueces County:* U. S. Naval Air Station, Corpus Christi (Auffenberg, 1948).

Intergrades (*C. c. coccinea* x *C. c. copei,* specimens examined). FLORIDA. *Alachua County:* Gainesville, CNHM 8573-8575, UF 454, 2504; 4 mi. S Gainesville, UF 4585; Payne's Prairie, UF 2731, 7062; 2.2 mi. S Hawthorne on U. S. 301, EEB 1193. *Levy County:* No other data, KU 74111; 4 mi. WSW Otter Creek, LSUMZ 7277. *Marion County:* No other data, CNHM 3388, KU 80997, UMMZ 52257; Ocala, USNM 142092; Silver Springs, CNHM 22665, 28483, 48443-48444.

Summary

The nomenclatural history of the genus is reviewed. *Cemophora* is the name utilized for the monotypic genus. We follow Smith, Lynch, and Puckette (1964) in using the name *Cemophora coccinea* (Blumenbach), 1788. These authors considered *Coluber doliata* Linnaeus, 1766, a senior synonym of *Coluber coccinea* but have asked for the former's suppression under the Plenary Powers of the International Commission on Zoological Nomenclature on the grounds of its long association with the milk snakes *(Lampropeltis triangulum).*

Cemophora coccinea may be distinguished by pattern alone from all other North America snakes, with the possible exception of some *Lampropeltis triangulum;* from the latter the scarlet snake may be distinguished by its large rostral and enlarged posterior maxillary teeth. The relationship of *Cemophora* to 5 genera *(Lampropeltis, Rhinocheilus, Stilosoma, Pituophis, Arizona)* usually considered as having phylogenetic affinities is examined. The scarlet snake appears to be most closely related to *Lampropeltis,* specifically to certain members of the *L. triangulum* group.

Selected characters were analyzed for individual, sexual, ontogenetic and geographic variation. Sexual differences were found in number of ventrals, proportional tail length, and to a lesser extent in number of body blotches. Ontogenetic variation occurs in pattern. The red blotches are lighter or even pinkish in young. The white interspaces on the dorsal pattern are immaculate in young and acquire dark pigment as the individual ages.

Three geographic races are distinguished on the basis of ventral number, supralabial number, and pattern. *Cemophora c. coccinea* (Blumenbach) of peninsular Florida is distinguished by a large number of ventrals (mean 174.0), normally 7 supralabials, and the 1st black blotch not touching pareitals (usually separated by 2 or more scales). *C. c. copei* Jan occurs along the Atlantic and Gulf coasts from New Jersey to eastern Texas, and inland to southern Illinois, southern Indiana, and southeastern Missouri; this race has a smaller number of ventrals (mean 165.3), normally 6 supralabials, and the 1st black blotch touching parietals or separated by less than 2 scales. *C. c. lineri* Williams, Brown, and Wilson of southern Texas (Kenedy County) has a large number of ventrals (mean 191.5), 7 supralabials, and the dorsal black blotches open ventrolaterally (closed in other two races). *C. c. coccinea* is closely related to *lineri,* as is evidenced by ventral and supralabial numbers. It would appear that Pleistocene climatic conditions caused a splitting of the range of *C. coccinea* driving the species into southern refugia in Texas, where *lineri* evolved, and Florida (and adjacent areas). When climatic conditions again became favorable *C. coccinea* moved northward into the Austroriparian region of southeastern United States. The Suwanee Straits barrier in northern Florida allowed the isolation necessary for the differentiation of *copei* from *coccinea.*

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Literature Cited

Anderson, P. 1965. *The Reptiles of Missouri.* Univ. Missouri Press, 330 pp.

Auffenberg, W. 1948. Airplane introduces *Cemophora coccinae* (sic) to Texas. *Herpetologica,* 4: 212.

..... and W. W. Milstead 1965. Reptiles in the Quaternary of North America. *in* W. E. Wright and D. G. Frey, The Quaternary of the United States. Princeton Univ. Press, pp. 557-568.

Baird, S. F. 1859. *Reptiles. Expl. Survey R. R. Route Mississippi River to Pacific Ocean (Williamson Route).* Washington, D. C., 10: no text, pls. 24-36.

..... and G. Girard 1853. *Catalogue of North American Reptiles in the Museum of the Smithsonian Institution.* Part 1. Serpents. Washington, D. C., xvi and 172 pp.

Bennett, E. 1953. An Illinois record of the scarlet snake. *Herpetologica,* 9: 164.

Blair, W. F. 1958. Distributional patterns of vertebrates in the southern United States in relation to past and present environments. *In Zoogeography,* American Assoc. Adv. Sci., pp. 433-468.

Blanchard, F. N. 1921. A revision of the king snakes: genus *Lampropeltis. Bull. U. S. Natl. Mus.,* no. 114: 1-260.

Blumenbach, J. F. 1788. Beytrag zur Naturgeschichte der Schlangen. *Magazin f. d. Neuste Ang d. Physi u. Naturg.,* 5: 1-13.

Boulenger, G. A. 1894. *Catalogue of the snakes in the British Museum (Natural History).* Vol. 2. London, xii and 382 pp.

Brimley, C. S. 1910. Records of some reptiles and batrachians from the southeastern United States. *Proc. Biol. Soc. Washington,* 23: 9-18.

..... . 1942. Reptiles and amphibians of North Carolina. *Carolina Tips,* 5: 2-3.

Brode, W. E., and P. Allison 1958. Burrowing snakes of the Panhandle counties of Mississippi. *Herpetologica,* 14: 37-40.

Brown, A. E. 1901. A review of the genera and species of American snakes, north of Mexico. *Proc. Acad. Nat. Sci. Philadelphia,* 53: 10-110.

Carpenter, C. C. 1954. Records of distribution for amphibians and reptiles of Oklahoma. Proc. Oklahoma Acad. Sci., 35: 39-41.

Carr, A. F., Jr. 1940. A contribution to the herpetology of Florida. *Univ. Florida Publ., Biol. Sci. Ser.,* 3: 1-118.

Cliburn, J. W. 1958. Notes on some snakes from Mississippi. *American Midl. Nat.,* 60: 196-201.

Collins, J. T. 1964. Additional records of the scarlet snake, *Cemophora coccinea* (Blumenbach) in Kentucky. *J. Ohio Herpetological Soc.,* 4: 106.

Conant, R. 1958. Notes on the herpetology of the Delmarva peninsula. *Copeia,* 1958: 50-52.

Cope, E. D. 1860. Catalogue of the Colubridae in the Museum of the Academy of Natural History of Philadelphia, with notes and descriptions of new species. *Proc. Acad. Nat. Sci. Philadelphia,* 12: 241-266.

..... 1888. On the snakes of Florida. *Proc. U. S. Natl. Mus.,* 11: 381-401.

..... 1892. A critical review of the characters and variations of the snakes of North America. *Proc. U. S. Natl. Mus.,* 14: 589-694.

..... 1900. The crocodilians, lizards, and snakes of North America. *Rept. U. S. Natl. Mus.,* 1898: 153-1270.

Corrington, J. D. 1929. Herpetology of the Columbia, South Carolina, region. *Copeia,* 1929, no. 172, pp. 58-83.

Daudin, F. M. 1803. *Historie naturelle, generale et particuliere des reptiles, pour faire suite a'l l'histoire naturelle de Buffon, redigee par Sonnini.* Paris, vol. 7, 436 pp.

Deckert, R. F. 1918. A list of reptiles from Jacksonville, Florida. *Copeia,* 1918, no. 54, pp. 30-33.

Dellinger, S. C., and J. D. Black 1938. Herpetology of Arkansas. Part 1. The Reptiles. *Occ. Papers Univ. Arkansas Mus.,* no. 1: 1-47.

Dickson, J. D., III. 1948. Observation on the feeding habits of the scarlet snake. *Copeia,* 1948: 216-217.

Ditmars, R. L. 1936. *The Reptiles of North America.* Doubleday and Co., New York, 476 pp.

Dowling, H. G. 1956. Geographic relations of Ozarkian amphibians and reptiles. *Southwest. Nat.*, 1: 174-189.

_____. 1957. A review of the amphibians and reptiles of Arkansas. *Occ. Papers Univ. Arkansas Mus.*, no. 3, 51 pp.

Duellman, W. E., and A. Schwartz 1958. Amphibians and reptiles of southern Florida. *Bull. Florida State Mus.*, 3: 181-324.

Duméril, A. M. C., G. Bibron, and A. H. A. Duméril 1854. *Erpétologie générale au histoire naturelle complète des reptiles.* Paris, vol. 7, pt. 1, 780 pp.

Fenneman, N. M. 1949. *Physical divisions of the United States.* U. S. Dept. Interior, Geol. Surv., text not numbered, map.

Force, E. R. 1930. The amphibians and reptiles of Tulsa County, Oklahoma and vicinity. *Copeia*, 1930: 25-39.

Fuller, T. C., and R. W. Barbour 1962. The distribution of *Cemophora coccinea* (Blumenbach) in Kentucky. *Copeia*, 1962: 637-638.

Garman, S. 1884. The reptiles and batrachians of North America. Part 1. Ophidians. *Mem. Mus. Comp. Zool.*, 8: 1-185.

Gmelin, J. F. 1789. *In* Linnaeus' *Systema Naturae.* 13th ed., Lipsiae, vol. 1, pp. 1033-1516.

Gunther, A. C. L. G. 1858. *Catalogue of Colubrine Snakes in the Collection of the British Museum.* London, 281 pp.

Haltom, W. L. 1931. Alabama reptiles. *Alabama Mus. Nat. Hist.*, 2: 145 pp.

Harlan, R. 1827. Genera of North American reptiles, and a synopsis of the species. *J. Acad. Nat. Sci. Philadelphia*, 6: 317-372.

Highton, R. 1956. Systematics and variation of the endemic Florida snake *Stilosoma.* Bull. Florida State Mus., 1: 73-96.

Holbrook, J. E. 1842. *North American Herpetology.* Philadelphia, 2nd ed., vol. 3, 128 pp.

Jan, G. 1862. Enumerazione sistematico delle species d'ofidi del gruppo Calamaridae. *Arch. Zool. Anat. Fis.*, 2: 1-76.

_____. 1863a. *Elenco sistematico degli ofidi descritti per l'iconografia generale.* Milan, 143 pp.

_____. 1863b. Enumerazione sistematica degli ofidi appartenenti al gruppo Coronellidae. *Arch. Zool. Anat. Fis.*, 2: 211-330.

Jobson, H. G. M. 1940. Reptiles and amphibians from Georgetown, South Carolina. *Herpetologica*, 2: 39-43.

Kauffeld, Carl F. and Harold Trapido 1944. Additional records of the scarlet snake in New Jersey. Copeia, 1944: 62-63.

King, W. 1939. A survey of the herpetology of Great Smoky Mountains Park. *American Midl. Nat.*, 21: 531-582.

Klauber, L. M. 1941. The long-nosed snakes of the genus *Rhinocheilus. Trans. San Diego Soc. Nat. Hist.*, 9: 289-332.

_____. 1946. The glossy snake, *Arizona*, with description of new subspecies. *Trans. San Diego Soc. Nat. Hist.*, 10: 311-398.

_____. 1948. Some misapplications of the Linnaean names applied to American snakes. *Copeia*, 1948: 1-4.

Latreille, P. A. 1802. *In* Sonnini, C. S. and P. A. Latreille, *Histoire naturelle des reptiles, avec figures dessinees d'apres nature.* Vol. 3, Paris, 335 pp.

Linnaeus, C. 1766. *Systema naturae.* 12th ed., Halae Magdeburgicae, vol. 1, 532 pp.

Merrem, B. 1820. *Versuch eines systems der amphibian Tentamen systematis amphibiorum.* Marburg, 191 pp.

Minton, S., Jr. 1944. Introduction to the study of the reptiles of Indiana. *American Midl. Nat.*, 32: 438-477.

_____ and H. B. Bechtel 1958. Another Indiana record of *Cemophora coccinea* and a note on egg-eating. *Copeia*, 1958: 47.

Mittleman, M. B. 1952. Another interpretation of *Coluber doliatus. Herpetologica*, 8: 22-25.

Neill, W. T. 1948. Hibernation of amphibians and reptiles in Richmond County, Georgia. *Herpetologica*, 4: 107-114.

_____. 1950. Ontogenetic changes in the coloration of the snake *Cemophora coccinea. Copeia*, 1950: 62.

_____. 1951. Notes on the natural history of certain North American snakes. *Publ. Res. Div. Ross Allen's Rept. Inst.*, 1: 47-60.

_____. 1957. Historical biogeography of present-day Florida. *Bull. Florida State Mus.*, 2: 175-220.

Nickerson, M. A. 1967. The scarlet snake *Cemophora coccinea* Blumenbach in Missouri. *Herpetologica*, in press.

Norris, K. S. 1958. The evolution and systematics of the iguanid genus *Uma* and its relation to the evolution of other North American desert reptiles. *Bull. American Mus. Nat. Hist.*, 114: 247-326.

Savage, J. M. 1960. Evolution of a peninsular herpetofauna. *Syst. Zool.*, 9: 184-211.

Schlegel, H. 1837. *Essai sur la physionomie des serpens.* Partie descriptive. Kips and Van Stuckum, La Hage, 606 pp.

Schmidt, K. P. 1954. Omissions from the sixth edition of the check list of North American amphibians and reptiles. *Copeia*, 1954: 304-306.

Smith, H. M. 1952. Commentary on the identity of *Coluber doliatus. Herpetologica*, 8: 26-27.

Smith, H. M., J. Lynch, and B. G. Puckette 1964. *Coluber doliata Linnaeus*, 1766 (Reptilia: Serpentes): proposed suppression under the plenary powers. *Bull. Zool. Nomencl.*, 21: 392-396.

_____. 1965. Proposed suppression of the snake name *Coluber doliatus* Linnaeus, 1766. *Herpetologica*, 21: 1-5.

Smith, P. W. 1961. The amphibians and reptiles of Illinois. *Illinois Nat. Hist. Surv. Bull.*, 28: 1-298.

Snyder, R. C. 1945. Notes on a captive scarlet snake. *Copeia*, 1945: 54.

Sowerby, J. 1804. The British miscellany. 2 vols. in 1, 76 pls., with descriptive text.

Stejneger, L. 1918. Nomenclatorial notes on milk snakes. *Proc. Biol. Soc. Washington*, 31: 99.

Stull, O. G. 1940. Variations and relationships of the snakes of the genus *Pituophis*. *Bull. U. S. Natl. Mus.*, no. 175: 1-225.

Underwood, G. 1966. A contribution to the classification of snakes. British Museum (Natural History), in press.

Walker, J. M. 1963. Amphibians and reptiles of Jackson Parish, Louisiana. *Proc. Louisiana Acad. Sci.*, 26: 91-101.

Werler, J. E., and J. McCallion 1951. Notes on a collection of reptiles and amphibians from Princess Anne County, Virginia. *American Midl. Nat.*, 45: 245-252.

Williams, K. L., B. C. Brown, and L. D. Wilson 1966. A new subspecies of the colubrid snake *Cemophora coccinea* (Blumenbach) from southern Texas. *Texas J. Sci.*, 18: 85-88.

Wilson, V. 1951. Some notes on a captive scarlet snake. *Herpetologica*, 7: 172.

Woolcott, W. S. 1959. Notes on the eggs and young of the scarlet snake, *Cemophora coccinea* Blumenbach. *Copeia*, 1959: 263.

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