

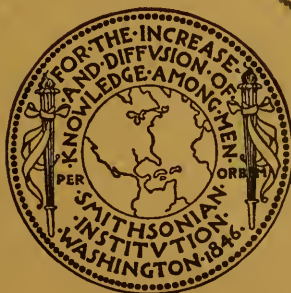
SMITHSONIAN MISCELLANEOUS COLLECTIONS

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FURTHER NOTES ON MEXICAN SNAKES
OF THE GENUS SALVADORA

BY

HOBART M. SMITH



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FURTHER NOTES ON MEXICAN SNAKES OF THE GENUS SALVADORA

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A review of the Mexican *Salvadora* in the National Museum, originally intended to fill out data on *bairdii*, has resulted in the discovery of two undescribed forms, one of them particularly interesting as illustrating an entirely new direction of evolution in the *grahamiae* group of the genus. As might be expected, this novel species originates in an isolated area not previously known to harbor any member of the group.

In addition, a third undescribed form, closely related to another isolated species recently described, was discovered by Dr. E. H. Taylor and Richard Taylor in an area so remote from that occupied by its close relative that its existence there is most remarkable. Through the courtesy of Dr. Taylor this form also is described herein.

The systematics of *Salvadora* is a highly interesting study, largely because of the unusual multiplicity of characters. This multiplicity at first led to confusion, as for example, in the era in the 1920's when but "*hexalepis*" and "*grahamiae*" were distinguished in the checklist area. Careful study of much larger collections in recent years, however, has shown the existence of a surprising number of truly recognizable forms.

The present review was undertaken and largely completed before it was known that the genus was in the process of review by the principal student of the group. Mr. Bogert most generously cooperated with me during the completion of the study, however, furnishing data on a number of specimens, and moreover giving me the benefit of certain conclusions reached by him with many more data than I have accumulated. In all cases, however, I have adhered to my original conclusions with regard to the status of the various Mexican forms, although I am aware that Mr. Bogert will have corrections and revisions to make. For this most generous aid and cooperation I am most grateful.

I am also indebted to Dr. E. H. Taylor for loan of specimens and help with data; to Dr. Norman E. Hartweg and K. P. Schmidt for help with data and in formulating ideas; to Dr. Howard K. Gloyd for

loan of specimens; and finally to William Stickel, who has criticized the work, made various helpful suggestions, and contributed to the construction of the key. The drawings have been prepared by my wife.

The entire study has been completed during tenure of, and with greatly appreciated assistance from, the Walter Rathbone Bacon Scholarship.

SALVADORA BOGERTI, new species

FIGURES 1, 2

Type.—U.S.N.M. No. 30296, female, from "Tehuantepec," collected by François Sumichrast.

Diagnosis.—Rostral slightly enlarged, edges somewhat free; dorsolateral dark stripes terminating on nape, not divergent, not crossing temporal region; lateral dark stripe not fused anteriorly with dorsolateral stripe; 9 supralabials; 2 loreals; anterior section of nasal separated from second supralabial; frontal in contact with, or narrowly separated from, preocular; posterior chin shields rather widely separated; ventral and caudal count low.

Description of type.—Rostral somewhat enlarged, with slightly free edges; seen from the front, the sides of the rostral diverge a little; anterior edge of rostral, seen from above, nearly straight; maximum width of rostral slightly greater than its distance from frontal; length of frontal subequal to length of parietals; distance of frontal from tip of snout three-fourths its length; frontal narrowly in contact with preocular on one side, narrowly separated on other; 9 supralabials, the fifth and sixth entering orbit; anterior section of nasal separated from second supralabial; 2 loreals, the lower much the smallest and wedged between preoculars, supralabials and upper loreal; 2 preoculars; 2 postoculars; temporals 2+2+3; seventh supralabial in contact with postoculars; 10-11 infralabials; posterior chin shields much smaller than anterior, separated from each other by a relatively large, elongate scale.

Ventrals 188; subcaudals 87, tail complete; scale rows 17-17-13; the third scale row dropped at the 117th ventral on one side, at the 116th on the other; the paravertebral rows are dropped at the 141st ventral.

Maxillary teeth 11+3.

Total length, 463 mm.; tail length, 115 mm.

Middorsal light stripe (cream in color) one and two half-scale rows wide at nape, one scale row wide at posterior end of body, its edges rather sharply defined; dorsolateral dark stripes slate gray, covering

two and two half-scale rows anteriorly, two and one-half rows posteriorly; these stripes terminate anteriorly at the nape, and do not diverge nor pass through the temporal region; most of the scales in the dorsolateral dark stripe have the anterolateral edge light colored (usually concealed), while the anteromedial and posterolateral edges are black; only the posteromedial edge is gray as the rest of the scale; a narrow lateral dark stripe anteriorly occupies the third scale row and the extreme outer edges of the fourth row; posteriorly (poste-

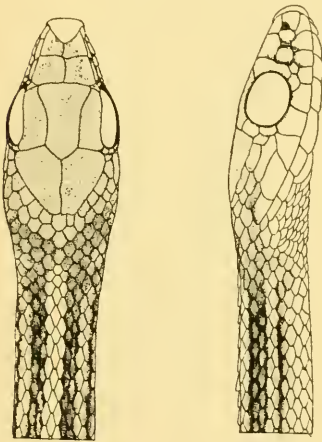


FIG. 1.—Cephalic scutellation of *Salvadora bogerti*, from type.

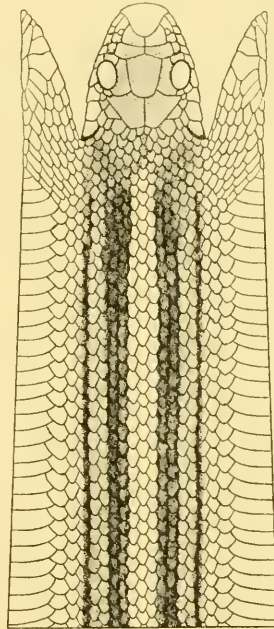


FIG. 2.—Pattern of head and neck of *Salvadora bogerti*, from type. Scale pattern hypothetical, based on that of *lineata*.

rior to point at which the third scale row drops) the lateral stripe is on the second and third rows; the lateral stripe disappears anteriorly at the nape, and does not merge with nor approach the dorsolateral dark stripes; posteriorly the lateral stripe disappears at the anus. Ventral surfaces immaculate.

Comparisons.—The caudal count, number of maxillary teeth, and several characters of the cephalic scutellation link this species with what might be termed the *grahamiae* group, and exclude it from the group or groups formed by the species *mexicana*, *lemniscata*, and

pulcherrima. However, the peculiar combination of characters possessed by it make dubious its closest relationship within the *grahamiae* group.

The locality data borne by the specimen (Tehuantepec) are not precise, but it may be assumed that the specimen was taken in some mountain range west of the Isthmus of Tehuantepec and perhaps in the area northwest of the city of Tehuantepec. It can be stated with some degree of assurance that the semiarid lowlands about the city of Tehuantepec do not harbor this species, else it probably would have appeared with the recent intensive collecting in that area.

Assuming this, it is apparent that the specimen comes from an area from which no others of the group are known. Furthermore, the mountain ranges of this area form a relatively compact group isolated faunistically and physiographically from the nearest other areas represented by specimens of the group.

Salvadora bogerti is comparable to *bairdii*, known from central Mexico as far south as southern Puebla, in two important characters: color pattern and the separation of the anterior section of the nasal from the second supralabial. The two most noteworthy similar features of the color pattern are: first, that the median light stripe narrows posteriorly to a width of one scale row; and second, that the dorsolateral dark stripes do not diverge anteriorly nor pass through the temporal region, but terminate on the nape. These two characters, held in common with *bairdii*, differentiate it from all other members of the group. The species is easily distinguishable from *bairdii* by the possession of 9 supralabials, higher number of maxillary teeth (9+3 normally in *bairdii*), enlarged rostral, 2 loreals, and probably by a lower average ventral and caudal count (the lowest counts in *bairdii* females are exactly the counts of *bogerti*).

The other Mexican species, *intermedia*, with its subspecies *richardi*, most closely situated geographically, differs widely from *bogerti* in color pattern, having the lateral stripe fused with the dorsolateral on anterior third of body, dorsolateral stripes passing through eye, a lower number of supralabials, single loreal, higher number of subcaudals, and separation of the antepenultimate supralabial from the postoculars.

From the geographically distant *lineata*, *hexalepis*, *grahamiae*, and their subspecies, *bogerti* differs markedly. *S. h. hexalepis*, *h. celeris*, and *h. virgultea* are the only forms of the genus normally with two loreals, and they moreover have the posterior chin shields widely separated as in *bogerti*, but from these *bogerti* may be distinguished in color pattern, the nasal-second labial character, smaller rostral, much

lower ventral and caudal count, etc. *S. h. deserticola* is perhaps more easily comparable to *bogerti* than any other form, as the scutellation of one is within the range of variation of the other, except for the nasal-second supralabial character and form of rostral, but the coloration is very different.

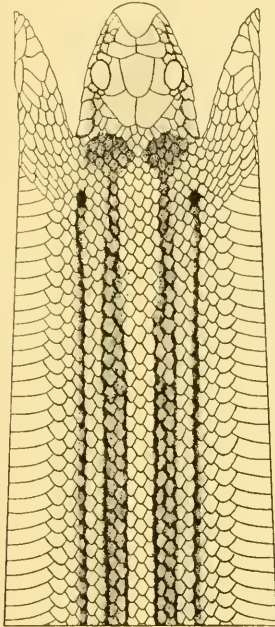


FIG. 3.—Pattern of head and neck of *Salvadora bairdii*, from U.S.N.M. No. 56576, Jalisco. Scale pattern hypothetical, based on that of *lineata*. Note great similarity of pattern in *bairdii* and *bogerti*, both of which have irregular black areas in the dark stripes.

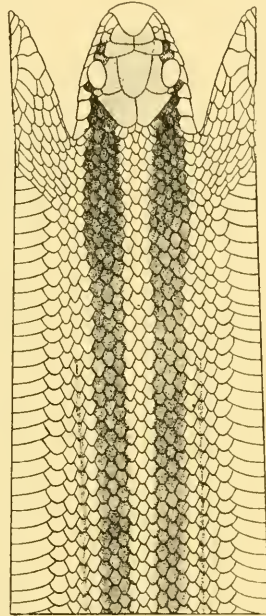


FIG. 4.—Pattern of head and neck of *Salvadora lineata*, from U.S.N.M. No. 105304, 17 miles west of Santa Caterina, Nuevo León. Texas specimens show a greater divergence of the dorsolateral dark stripes; the condition as shown is more or less characteristic of Mexican specimens.

S. grahamiac and *lineata* are so completely different from *bogerti* that comparisons are unnecessary.

Finally, the present specimen exhibits one character which, if found constant in the species, occurs in no other of the group. That is the contact or near contact of the frontal with the preocular. So universally are these scales separated in members of the *grahamiac* group that I would consider the condition in the type of *bogerti* anomalous if it were not for the fact that the same condition occurs frequently in *lemniscata* and *mexicana*.

Within the *grahamiae* group two smaller groups are apparent—one containing *intermedia* and *heralepis* (with their subspecies), the other containing *bairdii*, *grahamiae*, and *lineata*. Group I is characterized by normal possession by its members of 11+3 teeth and a pattern which involves fusion of the lateral stripe with the dorsolateral on the anterior part of the body. Some interesting gradations in ventral and caudal counts are apparent in this group. In group II the teeth are normally 9+3 or 10+3, and the lateral stripe, when present, remains distinct from the dorsolateral throughout its length. *S. bairdii* is by far the most distinct of group II and it is certainly the most primitive of either group, but its relationship with this group rather than with group I is apparent.

In determining the relationship of *bogerti* to these two groups, therefore, it is necessary to choose between emphasis on number of teeth, or on pattern, for the one links it with group I, the other with group II. It has been demonstrated in many groups of animals that certain details of pattern frequently are more stable than anatomical characters. I believe that this is another example of that phenomenon, since to me the pattern and geographical position of *bogerti* seem more significant and to link that species more definitely with *bairdii* than the considerable difference in number of teeth would imply.

SALVADORA INTERMEDIA RICHARDI, new subspecies

FIGURE 5

Type.—E. H. Taylor—H. M. Smith collection No. 23470, male, collected 1 mile north of Tehuacán, Puebla, August 8, 1940, by Richard Clark Taylor.

Diagnosis.—Rostral somewhat enlarged, with edges slightly free, its anterior border (viewed from above) nearly straight; 8 supralabials; antepenultimate supralabial separated from postoculars; maxillary teeth 11+3; lateral stripe fused with dorsolateral stripe, on anterior third of body, poorly defined; anterior section of nasal separated from second supralabial; ventrals 189 in male type.

Description.—Rostral somewhat enlarged, with slightly free edges; seen from the front, the sides of the rostral are nearly straight; anterior edge of rostral, seen from above, nearly straight; maximum width of rostral slightly greater than its distance from frontal; length of frontal subequal to length of parietals; distance of frontal from tip of snout nearly equal to length of frontal; 8 supralabials, fourth and fifth entering orbit; anterior section of nasal separated from second supralabial; 2 loreals on one side (the lower small and flat),

1 on the other; second supralabial broadly in contact with loreals; 2 preoculars on one side, 3 on other (the extra scale is split from the lower part of the upper preocular); antepenultimate supralabial separated from postoculars by a small scale; 2 postoculars; temporals 2+3 (2+2); 10 infralabials; posterior chin shields much smaller than anterior, separated from each other anteriorly by a small scale

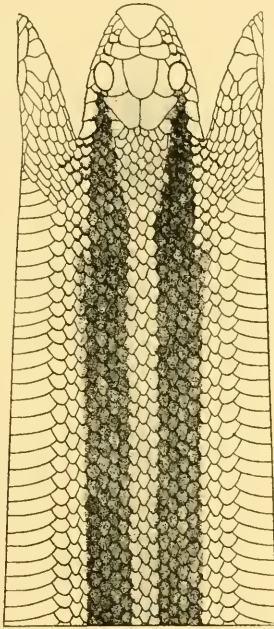


FIG. 5.—Pattern of head and neck of *Salvadora intermedia richardi*, from type. This pattern is duplicated in *i. intermedia*. Scale pattern hypothetical, based on that of *lineata*. Note similarity between this and *lineata* in character of pigmentation; both of these show the peculiar individual scale pattern on posterior part of body consisting of a white anterolateral and black antero-medial edge.

and a portion of end of an anterior chin shield, posteriorly by 2 small scales.

Ventrals 189; subcaudals indeterminate, 82 without tip; scale rows 17-17-13; third row dropped at the 115th ventral (114th on one side); paravertebral rows dropped at 122nd ventral.

Maxillary teeth 11+3.

Total length, 861 mm.; snout to vent, 657 mm.

Middorsal light stripe three scales wide at neck, gradually becoming narrower posteriorly, at posterior end of body one and two half-scale rows wide (the half-scale rows are dusky); dorsolateral dark stripes fused with lateral stripes anteriorly, the dark color extending to middle of third scale row; lateral stripe begins to show very dimly at about the 40th ventral, but only at the point at which the third row drops does it become clearly defined; posterior to this point the lateral row follows the third scale row to near the anus, where it disappears; the considerable lateral extension of the dorsolateral stripes contributes to the indistinctness of the lateral stripe; dark stripes diverging anteriorly and passing over temporal region to eye; ground color (slate gray, with a bluish tinge) extending onto ends of ventral surfaces; head somewhat brownish.

Anterior portion of belly white; edges of ventrals becoming pink in middle portion of belly; posterior third of belly light salmon pink; tail pink, becoming white toward tip (in preserved specimen).

Anterolateral edges of scales in dorsolateral stripes white, their anteromedial edges black (concealed).

Comparisons.—This form is very close to *intermedia*, agreeing with that in all pertinent details of color and pattern (including the pink belly), in form of rostral, number of labials and number of maxillary teeth. It differs from *intermedia* primarily in ventral count, the known range of variation in male *intermedia* being 175 to 181. It is impossible to state whether there are differences in caudal counts.

In the cephalic scutellation, it is most notable that the anterior section of the nasal is separated from the second supralabial in *richardi*, in contact in *intermedia*; secondarily it may be pointed out that the loreals are 1-2 and the preoculars 2-3.

These characters are very meager, but in their totality imply a significance; one or two such differences would not be notable; but the union in this specimen of so many, though minor, differences, coupled with the fact that the specimen comes from an area remote from that inhabited by *intermedia*, should be significant. Only future collecting will show whether the characters are constant.

The present specimen brings the range of *intermedia* as a whole very close to the known range of *bairdii*, which has been taken just 12 miles north of Tehuacán. The ranges of the two possibly overlap slightly in the area north of Tehuacán. However, it is very probable that, in general, *bairdii* does not extend south of Tehuacán, nor *richardi* very far north of Tehuacán, because this city coincidentally

is on the edge of a low, arid region which extends southward into the dry valleys of the Balsas Basin. The area is rugged and very dry, whereas the extensive plains north of Tehuacán are flat and become increasingly moist toward the north as elevation of the plains increases toward Puebla. It is noteworthy that, so far as is known, *bairdii* does not occur in extremely arid regions in any other part of its range. Furthermore, *i. intermedia* is confined, as far as known, to a mountainous habitat, similar in rainfall to that of *bairdii*, but isolated on all sides by extremely arid or tropical zones.

The subspecies *richardi* links *bairdii* and *intermedia* a little more closely, structurally as well as geographically. The presence in *richardi* of a higher number of ventrals, and the separation of the second supralabial and the anterior section of the nasal, are two steps toward the conditions exhibited by *bairdii*, which I consider the most primitive of the entire *grahamiae* group. It is rather obviously specialization in *i. intermedia* which produces low ventral count (lowest in the entire *grahamiae* group) and at the same time the naso-labial contact. The latter specialization is carried throughout all forms of group I, with the exception of *richardi*.

SALVADORA HEXALEPIS CELERIS, new subspecies

Type.—U.S.N.M. No. 40043, female, from San Blas, Sinaloa. Collected by J. N. Rose, March 28, 1910.

Diagnosis.—Rostral much enlarged; lateral dark stripe fused with dorsolateral at middle of neck; 9 supralabials; normally 1 or 2 loreals; ventrals 200 and 205 in known specimens; no trace of cross-banded effect in pattern. Maxillary teeth 11+3.

Description of type.—Rostral much enlarged, with very free edges, its anterior margin (seen from above) nearly straight; anterior section of nasal broadly in contact with second supralabial; latter separated from loreal; 2 loreals on one side, 1 on other; 2 preoculars; 2 postoculars; 9-10 supralabials, the antepenultimate separated from postoculars; temporals irregular, 2+2+3.

Infralabials 11-11; maximum length of anterior chin shields subequal to that of posterior chin shields; latter scales broadly separated on median line by 2 scales anteriorly, 3 posteriorly.

Dorsals in 17-17-13 rows, the third row dropped at the 131st ventral (129th on other side), the paravertebral dropped at the 158th ventral (162nd on other side); ventrals 200; subcaudals 77.

Maxillary teeth 11+3.

Median light stripe three scale rows wide over most of body, one and two half-scale rows wide posteriorly; dorsolateral dark stripe covering two scale rows over most of body, only one posteriorly, its edges serrate and corresponding rather exactly to the scales in the rows it follows; lateral dark stripe involving mainly the fourth row,

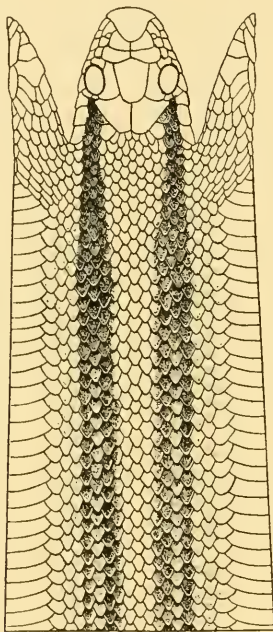


FIG. 6.—Pattern of head and neck of *Salvadora hexalepis deserticola*, from U.S.N.M. No. 22201, Ft. Huachuca, Arizona. This pattern is duplicated in *h. celeris*. Scale pattern hypothetical, based on that of *lineata*. Posteriorly the lateral line drops to the third row.

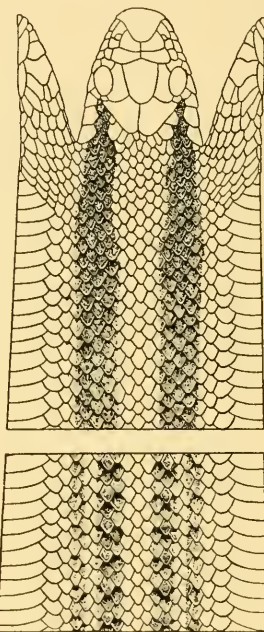


FIG. 7.—Pattern of *Salvadora h. hexalepis*, from U.S.N.M. No. 17500, Tucson, Arizona. Scale pattern hypothetical, based on that of *lineata*. Upper, head and neck; lower, middle of body. Note similarity in individual scale pattern between this and *deserticola*, both of which have the edges of the scales white, (not so in *grahamiae*, *lineata*, and *intermedia*); these two (all forms of *hexalepis*) lack the white anterolateral and black antero-medial corners characteristic of the other contrasted forms.

but also a small part of the third, on anterior part of body, descending posteriorly to the third row after loss of the third scale row anteriorly; dorsolateral stripe diverging anteriorly and passing through eye; lateral stripe fusing with dorsolateral stripe at middle of neck.

Ventral surfaces immaculate.

Comparisons.—This subspecies¹ is most closely related to *deserticola*. In coloration the two cannot be distinguished. Their only difference lies in ventral count, *deserticola* varying between 187 and 192 in 9 females, and from 184 to 195 in 11 males. Since these female counts average somewhat lower than males, the fact that the San Blas female has 200 is of special significance.

The only difference from typical *hexalepis* which can be stated definitely at present is in color pattern. In *hexalepis* the pattern is typically barred, i.e., there are at least alternating darker and lighter areas in the dorsolateral and lateral dark stripes. Usually the coinciding darker patches of the two stripes on a side are more or less fused into a larger, dim, dark spot or band. There is no indication of these cross bars in either *deserticola* or *celeris*.

The range of *celeris* presumably includes extreme southern Sonora as well as northern Sinaloa. The area is closely approached by *deserticola*, a specimen of which I have seen from Batopilas, Chihuahua. Mr. Bogert has kindly informed me of another specimen, also in the R. T. Moore collection (No. 17449)² which approaches still more closely the known range of *celeris*. This is from Yecorato, Sinaloa, which locality is probably in the same mountainous type of country as Batopilas; San Blas and Ahome are on a flat coastal plain. Intergradation of *celeris* and *deserticola* very likely occurs a short distance west of Yecorato, and very possibly *celeris* and *hexalepis* a short distance south of Guaymas, where numerous forms of mammals and lizards are known to intergrade or terminate their ranges. The line south of Guaymas is very well defined, and marks the boundary of the Arizonian and Sinaloan biotic provinces; the line to the west marks the boundary of the Durangan province, through the northern part of which the range of *deserticola* extends.

KEY TO MAINLAND MEXICAN SALVADORA

- 1. Lateral dark stripe involving first row of dorsal scales..... 2
 - Lateral dark stripe not involving first row of dorsal scales on any part of body 3
- 2. Stripes continued to occiput; ventrals immaculate, 196 to 208 in number *lemniscata*
 - Stripes interrupted anteriorly, cross bars on neck; spots on outer margins of anterior ventrals; ventrals 182 to 192 in number..... *mexicana*

¹ Probably identical with this is a specimen from Ahome, Sinaloa, in the collection of R. T. Moore at the California Institute of Technology (No. 17943). C. M. Bogert has kindly given me data on this specimen, which has 205 ventrals, 2 loreals, 9 supralabials (fifth and sixth entering eye).

² Bogert informs me that this specimen has 190 ventrals and 1 canthal.

3. Only one pair of dark stripes on body, these not involving third row of scales on any part of body..... 4
 Stripes involving third row of scales (figs. 2, 3, 4, 5, 7)..... 5
4. Antepenultimate supralabial separated from postoculars; maxillary teeth 11+3; stripes involving third and fourth rows of scales, bifurcated posteriorly (dorsolateral and lateral), but not well defined..... 5
 Antepenultimate supralabial usually in contact with postoculars; maxillary teeth usually 10+3; only dorsolateral stripes present, well defined, not involving either the third or the fourth scale rows anteriorly...
g. grahamaiae
5. Dorsolateral dark stripes terminating on nape and not passing through temporal region (figs. 2, 3)..... 6
 Dorsolateral dark stripes diverging on neck and passing through temporal region to eye (figs. 4 to 7)..... 7
6. Loreals 2; rostral with slightly free edges, anterior margin (seen from above) nearly straight; maxillary teeth 11+3; 9 supralabials (figs. 1, 2).
bogerti
 Loreal 1; edges of rostral not free, its anterior margin (seen from above) distinctly convex; maxillary teeth usually 9+3; usually 8 supralabials (fig. 3).....*baïrdii*
7. Lateral dark stripe fusing with dorsolateral dark stripes on neck (figs. 5, 6, 7)..... 8
 Lateral dark stripe distinct and separate from dorsolateral throughout its length, generally disappearing free on neck, rarely discernible to temporal region (fig. 4).....*grahamaiae lineata*
8. Rostral strongly enlarged, with prominently free edges; 9 supralabials or more; antepenultimate labial generally in contact with postoculars..10
 Rostral moderately enlarged, with somewhat free edges; 8 supralabials; antepenultimate labial usually separated from postoculars..... 9
9. Anterior section of nasal in contact with second supralabial; ventrals 182 or less.....*i. intermedia*
 Anterior section of nasal separated from second supralabial; ventrals 190 in single specimen (fig. 5).....*intermedia richardi*
10. A distinct barred effect in pattern; lateral stripe fused with dorsolateral over all of neck (fig. 7).....*h. hexalepis*
 Pattern not barred, the stripes uninterrupted in intensity; lateral stripes fused with dorsolateral over anterior half or third of neck (fig. 6)....11
11. Ventrals 195 or less (fig. 6).....*h. deserticola*
 Ventrals 200 to 205 (in two specimens).....*h. celeris*