

A New Terrestrial Pit Viper of the Genus *Bothrops* (Reptilia, Serpentes, Crotalidae) from Western Mexico

Jonathan A. Campbell

Department of Biology, The University of Texas at Arlington,
Arlington, Texas 76019, USA

ABSTRACT—*Bothrops hesperis* from the xeric foothills of Colima, Mexico, is a new member of the "hognose" viper group. It differs from other members of this group in lepidosis, coloration, pattern, and distribution which is further to the northwest than that of its congeners.

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The southwestern portion of Mexico is one of its least explored areas herpetologically. In the last two decades several new crotalids have been described from the mountainous areas adjacent to the Pacific coast: *Crotalus lannomi* Tanner (1966) from the extreme southwestern escarpment of the transverse volcanic cordillera, *Bothrops sphenophrys* Smith (1959) from the Sierra Madre del Sur, and *B. rowleyi* Bogert (1968) from the western portion of the Sierra Madre de Chiapas. The former two remain known only from the types, and only a few additional specimens of *B. rowleyi* have been found. Furthermore, the two other west Mexican species of the genus *Bothrops*, *B. barbouri* (Dunn, 1919) and *B. undulatus* (Jan, 1859) are not often encountered and are rare in collections. Probably the foremost reason for the apparent rarity of these crotalids is that access to many areas is nearly as difficult today as it was a century ago. Sporadically passable roads cut across the mountains, but they generally follow the lower passes; only by mule or on foot is entrance to some of the more remote and interesting areas possible.

Nevertheless, the discovery of an apparently new species of *Bothrops* in the rugged foothills in the state of Colima late in 1973 came somewhat unexpectedly. Colima is a small state (2106 miles²) from which large collections of reptiles have been assembled, and its herpetofauna has been reviewed by several investigators (Duellman, 1958; Oliver, 1937; Smith and Taylor, 1945). Also, consideration of the distribution of the other members of the genus would perhaps make this northwestern extension unlikely.

Only four other species of *Bothrops* are definitely known from the Pacific drainage in the mountains west of the Isthmus of Tehuantepec. Three of these do not share close affinities with the Colima specimen; *Bothrops barbouri*, *B. undulatus*, and *B. sphenophrys* are all inhabitants of pine-oak or cloud forests at high elevations usually above 1800 m. *Bothrops barbouri* and *B. undulatus* are known from portions of the Sierra Madre del Sur west of Chilpancingo, Guerrero, with the latter also ranging well into Oaxaca and other parts of Mexico where suitable habitat exists. *Bothrops sphenophrys* is recorded only from extreme south-central Oaxaca near La Soledad. *Bothrops undulatus* and *B. sphenophrys* differ from the Colima specimen in having protuberant supraoculars, finely divided head scales, divided subcaudals, and in being semi-arboreal. *Bothrops barbouri* shares a few characteristics with the Colima specimen in being terrestrial and having undivided subcaudals. However, *B. barbouri* obviously has its

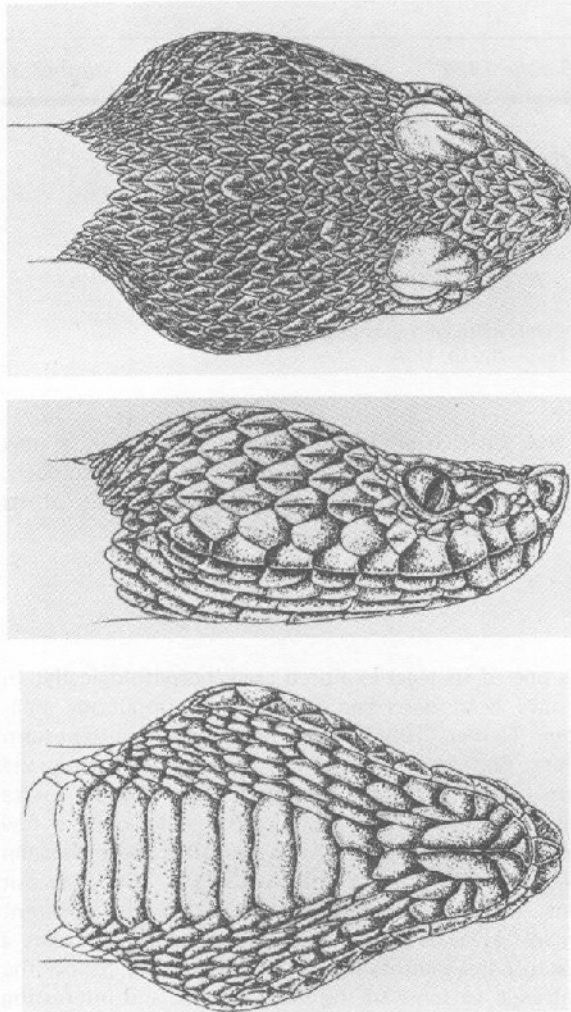


FIGURE 1. *Bothrops hesperis*, holotype, UTA No. R-4443, showing arrangement of head scales.

affinities with *B. godmani* farther to the southeast in Mexico and Central America. In addition to habitat difference, it has rather flat and enlarged, though variable, head scales and fewer scale rows at midbody (17 as compared to 23) than the Colima specimen. The existence of the large terrestrial *B. asper* on the Pacific coast west of the Isthmus has not been established. Smith and Taylor (1945:180) pointed out the improbability of the Guerrero record of Boulenger (1896).

The only species found in this geographic area with which the population represented by the Colima specimen appears to share close affinities is *B. dunnii*. This species occurs at low elevations (150-800 m) in the southern foothills of the Pacific slope of the Isthmus of Tehuantepec, some 800-900 km ESE of the locality at which the Colima *Bothrops* was taken. No other species of *Bothrops* is known from the relatively low altitudes in the interlying area of the Pacific versant between the range of *B. dunnii* and the source of the Colima specimen and, as far as is known, no species of *Bothrops* in western Mexico, other than the Colima population, seemingly derived from the same ancestral stock as *B. dunnii*, has succeeded in crossing the formidable barrier presented by the Río Balsas basin. A comparison of the Colima *Bothrops* with *B. dunnii* and other members of the so-called "hognose" vipers leaves little doubt that it represents a distinct species meriting description on the basis of a single specimen. Owing to its distribution, I am prompted to name it

Bothrops hesperis, sp. nov.

Holotype.—No. R-4443 in the Collection of Vertebrates, The University of Texas at Arlington, an adult female, taken on a west-facing slope in the foothills ca. 12 airline km NE of Tecomán, Municipio de Ixlahuacán, Colima, Mexico, on 15 October 1973, by Santos Aviña. This site lies between the Río Armería drainage and the Río Salado (a tributary of the Río Coahuayana) at an elevation of approximately 300 m.

Diagnosis.—The information in the following account is derived from specimens examined augmented by data obtained from the literature.

Bothrops hesperis has its nearest affinities with members of the genus *Bothrops* commonly called the "hognose" vipers. This group is comprised of at least seven morphologically similar terrestrial species which have been separated previously with some difficulty (Amaral, 1927, 1929; Dunn, 1928).

Bothrops hesperis differs from *B. hyoprora*, *B. nasutus*, and *B. pessoai* (known only from the type; Prado, 1938-39) in having more ventrals, 157 as compared to a maximum number of 134, 145, and 128 respectively. In addition, *B. hesperis* has fewer subcaudals, 39, than either *B. hyoprora* or *B. pessoai*, which have minimums of 44 and 57 respectively. Although all are lowland forms, a distinct difference in habitat exists; *Bothrops hesperis* inhabits an environment that is distinctly xeric, while the other three apparently are restricted to mesic tropical forests.

Four other species in this group, *B. dunnii*, *B. yucatanicus*, *B. lansbergii*, and *B. ophryomegas* inhabit areas, which like that of *B. hesperis*, are also rather xeric, at least seasonally. Of these, *B. ophryomegas* is the most easily distinguished from *B. hesperis* by having two canthals instead of one on each side, having rather small and only very slightly upturned internasals, a high number of ventrals (160 to 173), and more numerous body blotches (27 to 40 compared to 17). The condition of the preoculars and internasals distinguishes *B. hesperis* from *B. dunnii* and *B. yucatanicus*. In *B. hesperis* the middle preocular is not divided vertically and extends over the upper border of the pit. Furthermore, the middle preocular is excluded by the upper and lower preoculars from bordering on the orbit (Fig. 1). Invariably the middle preocular is vertically divided in 18 specimens of *B. dunnii* examined and 23 of 27 specimens of *B. yucatanicus* examined share this characteristic (see Fig. 2 for *B. dunnii*). In *B. dunnii* the middle preocular is not excluded from the orbit, while it usually is in *B. yucatanicus*. The internasals in *B. hesperis* are only moderately raised and the canthus rostralis is more or less horizontal in lateral aspect. In *B. dunnii* and *B. yucatanicus*, however, the internasals are distinctly raised and the canthus rostralis is strongly curved upward anteriorly in lateral view. Additionally, *B. hesperis* differs from *B. dunnii* and *B. lansbergii* in having a greater number of subcaudals for females, 39 compared to a maximum of 37 and 35 respectively. *Bothrops hesperis* differs from *B. yucatanicus* in having a greater number of ventrals than is known for females of this species, 157 compared to 155. Also, *B. hesperis* further differs from *B. dunnii*, *B. yucatanicus*, and *B. lansbergii* with respect to the number of scales rows a head's length anterior to the vent, 17 compared to 19 for all three of the latter.

Distinct differences in pattern and coloration are present. *Bothrops hesperis*, *B. dunnii*, *B. yucatanicus* and *B. lansbergii* all have a thin light-colored vertebral line on each side of which are arranged opposite or alternating blotches. In *B. lansbergii* these blotches are rather solidly pigmented between their borders and the vertical borders give the blotches a squarish appearance. In *B. dunnii* and *B. yucatanicus* these blotches have a tendency to be divided from below by the ground color. This bisection gives each blotch a "double" appearance. In both of these species,

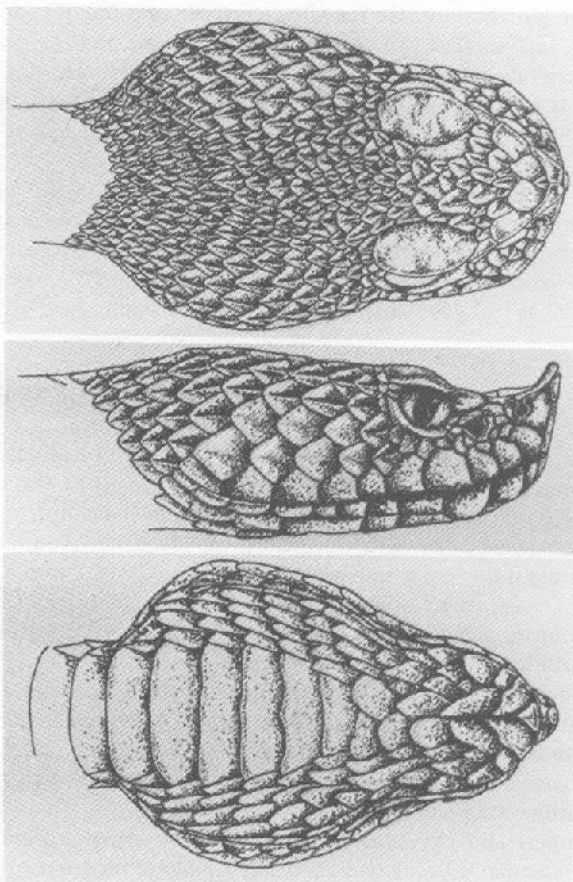


FIGURE 2. *Bothrops dunnii*, paratype, UMMZ No. 82739, showing arrangement of head scales.

the blotches are also basically squarish, and the outside and inside borders of the blotches are more or less vertical. In *B. hesperis*, however, this pairing is much more pronounced with a more extensive intervention of the ground color between the outside borders of the blotches. Anteriorly, it is difficult to distinguish a blotch "pair" as they alternate to form a zig-zag dorsal blotch. The borders of the dorsal blotches mostly are diagonal relative to the ground, forming triangular instead of squarish blotches.

Bothrops microphthalmus may also be in this group, although this allocation should remain tentative until the interspecific relationships of the entire genus (as recognized at present) are more adequately understood. This species appears to be closely related to the aforementioned South American rain forest forms, *B. hyoprora* and *B. pessoai*, but is easily separated from *B. hesperis* as well as from all other members of the group in having divided subcaudals.

DESCRIPTION OF THE HOLOTYPE

Dimensions (before preservation).—The over-all length of the specimen is 579 mm. The tail length is 74 mm and comprises 12.8 per cent of the total length. At its broadest point the head is 22.0 mm and is 29.4 mm from the tip of the snout to angle of jaw. The diameter of the neck at its narrowest point directly behind the jaws is 11.4 mm. The length of the right fang measured in a straight line from the upper lumen to tip is 18.2 mm.

Lepidosis.—The rostral is higher than broad (3.7 X 2.8 mm) and bordered laterally by the anterior nasal and first supraocular. Vertically, the nostril is situated approximately midway in the suture dividing the anterior and posterior nasals. Following the postnasal lies a loreal that is bounded above by a canthal, below by prefoveals and the prelacunal, and posteriorly by the upper and middle preoculars. There are 4/4 prefoveals, 2/2 subfoveals, and 2/2 postfoveals. A large prelacunal that touches the loreal and middle preocular above is bordered anteriorly and below by foveals. It contacts the sublacunal posteriorly which lies almost entirely within the pit and is visible externally only at its posterior margin. There are three preoculars; the upper is by far the largest and curves over the top of the crown forming part of the canthus rostralis. The middle preocular is undivided vertically and extends anteriorly over the top of the pit. It tapers to a point posteriorly and therefore is almost entirely excluded from bordering the orbit. The lower preocular is small and roundish and in broad contact with the orbit. All of the suboculars and some of the postoculars are fused and form a single elongate scale that curves upward posteriorly. There are two free postoculars on each side between this elongate scale and the supraocular. There are 3/3 interoculars. The supralabials are 10/10 with the pit and eye situated above the third and fifth supralabial respectively. The fourth and fifth supralabials are the largest. Scales in the temporal region vary from slightly to strongly keeled with the exception of the first scale row above the sixth to ninth supralabials which is unkeeled.

The scales in contact with the rostral consist of two moderately upturned internasals with widths roughly three times their lengths. The suture between these is off to the left so that the right internasal is larger. Following the internasals is a single canthal on each side, between which lie four scales more or less the same size and all in contact with the internasals (see Fig. 1). The supraoculars are large, not quite as long as broad, between which are four scales at the narrowest point. There are two small head scales between the canthals and the supraoculars. A distinct canthus rostralis is formed by the internasals, canthals, upper preoculars, and supraoculars. All of the smaller dorsal head scales from the prefrontal to the parietal area are strongly keeled.

The mental is broader than long (3.7 X 2.5 mm). The infralabials number 12/11. There is a pair of chin shields in contact with the first four infralabials on the right and with three on the left (Fig. 1). Two pairs of gulars lie between the chin shields and the first ventral (definition of Klauber, 1972:117).

The dorsal scales are disposed in 25-23-17 rows and all of them are strongly keeled except those in the first and second rows, on which the keel is absent or weak. There are 157 ventrals using Klauber's (1972) definition of the first ventral, or 156 following Dowling (1951). The anal is

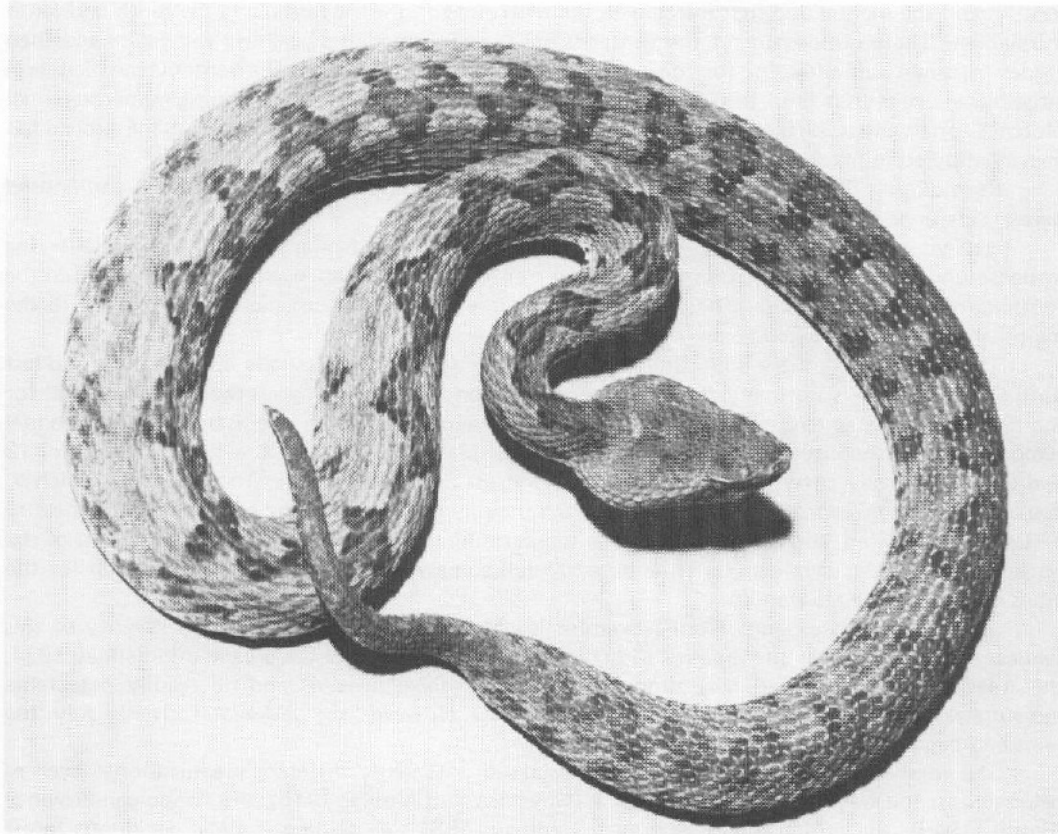


FIGURE 3. *Bothrops hesperis*, holotype, UTA No. R-4443, live specimen.

undivided as are the 39 subcaudals. The tail spine is straight and sharply pointed at the end; as long as the preceding $2\frac{1}{2}$ subcaudals, slightly compressed laterally with dorsal and ventral keels distally; it has one dorsal scale, slightly to the right side, capping the base.

Pattern and coloration (from life).—The head is pinkish and without pattern. The iris is bronze with black flecks. A brownish-gray postocular stripe extends from behind the eye downward to the seventh supralabial and diagonally across to the posterior angle of the jaw. A golden-brown vertebral line runs from the nape to a point midway on the tail on either side of which are present alternating or opposite greenish-brown blotches. The lower edges of these blotches are open with a light gray ground color bisecting the blotches, giving them the appearance of being arranged in paired components. There are 17 blotches on each side. The ground color alternates from light gray in the area between the two components of a single blotch to orange between two blotches. The alternation of the ground color gives a banded appearance that becomes more evident posteriorly. The double or paired nature of the blotches is readily discernible posteriorly, however anteriorly the blotches become more open and form a zig-zag pattern making recognition of a blotch pair more difficult. The dorsal blotches extend from the paravertebral scale row diagonally downward three scale rows. The opposing outside and inside borders of these blotches are diagonal to the ground and converge to form a triangle (Fig. 3). Thus, schematically each blotch consists of two contiguous triangles. Each of these triangles is offset laterally by a small, roundish, charcoal gray blotch approximately two scale widths by one and a half scale lengths and situated on scale rows two, three, and four. Dorsally, the anterior portion of the tail has three blotches with the distal half a dark gray.

The gular area is whitish with a few widely dispersed black flecks. There is a brownish-green

mottling on the mental and first infralabial, the fifth and sixth infralabials, and the ninth and tenth infralabials. The ground color of the venter is light pink immediately behind the gulars and then grades to bright salmon color for the posterior two-thirds of the body. The venter is mottled with large black flecks that tend to be arranged in clumps, especially laterally, forming numerous small blotches. The ventral surface of the tail is light yellow with the lateral borders of the subcaudals heavily stippled in black.

Etymology.—The specific name is from the Greek *hesperos* meaning the West and is used here in reference to the distribution.

Habitat.—The holotype of *B. hesperis* was taken on a west-facing slope coiled on a fallen log in dense undergrowth about 10 m from a small trail. The site is at an elevation of ca. 300 m in the foothills of southern Colima. These foothills rise rather abruptly from the coastal plain with the majority of the peaks ranging from 400 to 700 m in elevation.

There is a marked dry and rainy season in the area. The rains usually begin in June and last until October; July is normally the wettest month. Contreras (1942) gives the average rainfall for the city of Colima as 876 mm with an average of 80 rainy days a year. He lists the average annual temperature for the city of Colima as 24.6 C and for Manzanillo as 26.1 C with a difference of 13 and 9 C respectively between the means of the hottest and coldest days. The area from which *B. hesperis* was taken appears to be more arid than the plateau 35 km to the north on which the city of Colima is situated, and the average annual temperature and difference between the means of the hottest and coldest days can be anticipated to fall somewhere between the means given for the cities of Colima and Manzanillo.

The dry season extends from November to May and it is the length and severity of this rainless season that gives the area its arid character. When we visited the area in middle May 1974, the trees of the forest had lost almost all of their foliage (Fig. 4) and no readily detectable moisture remained under even the largest rocks or logs. However, six weeks later in early July, the rains had begun and the forest was luxuriantly green.

The vegetational association has been described on slightly different organizational levels as belonging to the Nayarit-Guerrero Province (Goldman and Moore, 1946), the Acapulcan Province (Smith, 1949), the arid tropical subzone (Goldman, 1951), as being a tropical deciduous forest (Leopold, 1950), and as a seasonal formation series (Wagner, 1964). The forest where *B. hesperis* was taken is low, not exceeding 10 m in most places, but quite dense. Some of the primary trees have been identified (Duellman, 1958; Goldman, 1951; Goldman and Moore, 1946) as *Bombax*, *Brosium*, *Castilla*, *Ficus*, *Ipomoea*, *Licania*, and *Bursera*, the "palo colorado" or red paper-bark tree. These can attain a considerable height and are found primarily in the valleys of the escarpment or along river courses. The rest of the forest is much lower and consists mainly of Leguminosae including species of *Acacia*, *Mimosa*, and *Prosopis*. Other prominent plants are *Randia* and *Lemaireocereus*, the giant organ cactus, which is widely dispersed throughout the forest. We found the rank-growing nettle spurge or "mala mujer" (*Cnidocolus*) extremely common everywhere.

Remarks.—Residents living near the area from where the holotype of *B. hesperis* was taken appeared to be familiar with the species. We were assured that it was encountered with some frequency, especially at the end of the rainy season in November and December when the foliage becomes less dense. Also it was during this period that they were more actively cutting wood in the area which could only be reached on foot. In the vicinity of Ixlahuacán, we were told that the snake was also occasionally discovered, but that it was more common in the hills to the south, roughly in the direction of the type locality. Several residents also claimed they had seen this species on the Cerro de San Gabriel. We were unable to reach this mountain which lies 20 km NNE of Tecomán, but from a distance it appeared to be of similar habitat as the type locality. A few residents referred to our specimen as "colmillo de puerco" which they distinguished from "hocico de puerco" (*Loxocemus bicolor*). Santos Aviña while cutting wood discovered the holotype of *B. hesperis* which he misidentified as *Boa constrictor*. Subsequently, he was bitten on the right index finger, with enough venom injected to cause much pain and swelling of the arm. He was released after being treated for several days at a hospital in Colima, but suffered permanent stiffness in his finger.



FIGURE 4. Habitat of *Bothrops hesperis*, 12 airline km NE Tecoman, Colima, Mexico. May 1974.

The holotype of *B. hesperis* was maintained alive from the date of its capture until 15 October 1974 at which time it was preserved. It was kept in a 15 gal. aquarium at a constant temperature of 23 C. White laboratory mice (ca. 25 g) were accepted readily from its first month in captivity. The snake was very nervous and coiled and struck at the least provocation.

DISTRIBUTION OF THE HOGNOSE VIPERS IN MEXICO

Of the four species of this group occurring in Mexico, only *B. nasutus* inhabits a decidedly mesic environment. Its range in Mexico falls entirely within the rain forest zone as described by Leopold (1950). As indicated previously, this species, along with other members of the group inhabiting mesic habitats, appears to be more distantly related to members occurring in xeric environments.

The distributions known for the remaining three Mexican species are widely separated (minimum distances of approximately 800 km), but they nevertheless inhabit vegetation zones that are similar. The ranges of *B. hesperis*, *B. dunnii*, and *B. yucatanicus* all lie entirely within the tropical deciduous forest zone as described by Leopold (1950). *Bothrops yucatanicus*, in the northern portion of the Yucatan Peninsula, is geographically isolated from the two west coast species. However a corridor of tropical deciduous forest connects the ranges of *B. dunnii* and *B. hesperis* and it seems probable that their differentiation followed the dispersal and subsequent fragmentation of a common ancestral stock. The reasons for the isolation of the Colima population remain obscure in view of the connecting habitat. Nevertheless, other relicts endemic

TABLE 1. Variations observed or reported in *Bothrops hesperis* and *B. dunnii* (Extremes in parentheses).

	<i>Bothrops hesperis</i>	<i>Bothrops dunnii</i>
dorsal scale rows	25-23-17	Usually 23-23-19, rarely 23-21-19 or 21-21-19
subcaudals	39	(30) 32.6 (37)*
preoculars	middle preocular excluded from orbit; not divided vertically	middle preocular not excluded from orbit; divided vertically
infralabials	12/11	equally 10 or 11, never 12
intercanthals	4 equal sized scales	usually 2 large scales; or when more than 2, with smaller median scales
internasals	moderately elevated	strongly elevated
sublacunal	only posterior margin exposed to exterior	entire length exposed to exterior
adult total length	579 mm	(311 mm) 400 mm (542 mm)**
tail spine	capping scale extending less than half of tail spine length; ventral surface horizontally flat	capping scale extending almost to tip of tail spine; ventral surface curved upward at tip
pattern and coloration	blotches forming triangles; ground color alternating gray and orange bands	blotches forming squares; ground color uniformly pallid gray
distribution	southern Colima	southeastern Oaxaca

(*based on 11 females)

(**based on 14 adult specimens)

in the arid lowland of Mexico exhibit this same pattern of distribution, the most characteristic being perhaps the Mexican species of the lizard genus *Enyaliosaurus*. The range of *E. defensor* in the Yucatan Peninsula closely parallels that of *B. yucatanicus*. *Enyaliosaurus quinquecarinatus* from the lowland region of southeastern Oaxaca has a distribution roughly coextensive with that of *B. dunnii*. The more northern species, *E. clarki*, from the arid Tepalcatepec Valley in Michoacán, may prove to share its range with *B. hesperis*. Duellman and Duellman (1959) discussed the distribution of *E. clarki* and suggested that it ranges into the southeastern arm of Jalisco that separates Michoacán from Colima. Furthermore, Duellman (1958) pointed out the similarity of the herpetofauna of the Tepalcatepec Valley and the lowland of Colima and suggested a possible dispersal route between the two areas through the low pass that separates the headwaters of the Río Tepalcatepec and Río Coahuayana.

As *B. hesperis* appears to be most closely related to *B. dunnii*, a detailed comparison was made with the more salient differences presented in Table 1. For this comparison I have drawn from the observations of Hartweg and Oliver (1938) as well as a re-examination of the paratypes of *B. dunnii*.

MATERIAL EXAMINED

I have examined specimens lent by: the Carnegie Museum (CM), the Field Museum of Natural History (FMNH), the Museum of Zoology, the University of Michigan (UMMZ), as well as the Collection of Vertebrates, the University of Texas at Arlington (UTA).

Bothrops hesperis (1): UTA No. R-4443, ca. 12 airline km NW Tecomán, Municipio de Ixlahuacán, Colima, Mexico, 300 m (holotype).

Bothrops dunni (18): (all from the state of Oaxaca, Mexico). UTA No. R-4367, 10 miles NW Tehuantepec; UTA No. R-4368, Paso Alicia (NW Tehuantepec); UMMZ Nos. 82733-5*, vicinity of Tehuantepec; UMMZ No. 82736*, Quiengola Mt., 8 km NW "Oaxaca" (in error for Tehuantepec); UMMZ Nos. 82737-43*, San Pedro Mt., S Tehuantepec; UMMZ No. 82745*, between San Pedro Mt. and Tehuantepec; UMMZ No. 82746*, Mixtequilla Mt., 6 km N Tehuantepec; UMMZ No. 112510, 11 miles E Tehuantepec; UMMZ No. 124745, 31.4 km E Tequisistlán; UMMZ No. 131324, "Totalapan" (Totolapan?), "12 miles E Oaxaca" (48 miles SE Oaxaca?). (* paratypes)

Bothrops yucatanicus (27): CM Nos. 47171-3, 47187, 47189, 47191, 47194, 49845, 49853-4, 49857, 49866, 49869, 49872, and 49874, Piste Yucatán, Mexico, Mexico; CM Nos. 45822, 45825, 46901, 47075-7, 49052, 49071, 49096, 49146, 49160, and 49165, Pueblo Nuevo X-can, Quintana Roo, Mexico.

Bothrops lansbergii (9): UTA Nos. R-3673-81, all from the vicinity of Santa Marta, Magdalena, Colombia.

Bothrops ophryomegas (4): (all from Costa Rica). UTA No. R-3400, 23.1 miles N Liberia; UMMZ Nos. 83183-4, Esparta; UMMZ No. 131334, Alajuela, San Carlos; UMMZ No. 131335, Puntarenas, Tarcoles.

In addition, I have examined (4) specimens of *B. hyoprora* (FMNH Nos. 27597, 56171, 83079, 165849), (2) specimens of *B. nasutus* (UTA Nos. R-3682, R-5104), and (3) specimens of *B. microphthalmus* (FMNH Nos. 5580, 40242, 63740).

ACKNOWLEDGMENTS

I am grateful to Dr. A. G. Kluge, Mr. Hymen Marx, and Dr. C. J. McCoy for permitting me to examine specimens in their care; to Jerry R. Glidewell, Harry W. Greene, James B. Murphy, and Charles J. Rutledge for helpful suggestions; to Dr. Charles M. Bogert for offering criticism that substantially improved the paper; to Donna Campbell who undertook the task of preparing all the drawings; to Barry Armstrong and John E. Cofer for assistance in the field and darkroom respectively; to the government officials in Mexico of the Departamento de Conservación de la Fauna Silvestre, Secretaría de Agricultura y Ganadería who courteously issued collecting permits; and especially to Dr. William F. Pyburn for reviewing the several drafts, giving me continued encouragement, and suggesting the name *hesperis*. To all these persons, my sincere thanks. Financial support was given by The University of Texas at Arlington Chapter of the Sigma Xi.

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