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THREE NEW SPECIES OF THREAD SNAKES (SERPENTES: LEPTOTYPHLOPIDAE) FROM HISPANIOLA

Richard Thomas, Roy W. McDiarmid, and Fred G. Thompson

Abstract.—Three new species of thread snakes of the genus *Leptotyphlops* are described from Hispaniola as: *L. calypso* from the Samaná Peninsula, and *L. asbolepis* from the Sierra Martín García, Dominican Republic, and *L. leptepileptus* from the Massif de la Selle, Haiti. These three species together with *L. bilineatus* and *L. pyrites* form a distinct group of *Leptotyphlops* that is restricted to the West Indies. All five species are compared and a key to the seven species of the genus known from the West Indies is presented.

The first collection of a leptotyphlopid from Hispaniola (Thomas 1965) resulted in increased field effort to secure additional specimens of these secretive snakes. Further collecting yielded species of this genus different from *Leptotyphlops pyrites* Thomas from three widely scattered points on the island (Fig. 1): The Samaná Peninsula and the Sierra Martín García in the Dominican Republic and the north slopes of the La Selle Massif in Haiti. The snakes from each of these localities not only are distinct from *L. pyrites* but also from one another. Field work during the past few years also has extended the known range of *L. pyrites* from the vicinity of the type-locality near Pedernales, Dominican Republic, west into Haiti along the south coast and north into the Valle de Neiba.

Thomas (1965) considered *Leptotyphlops bilineatus* Schlegel of the Lesser Antilles and *L. pyrites* to be the only known members of a distinct Antillean group. The defining feature of this "*bilineatus* group" was the presence of two subocular supralabial scales that prevent the ocular scale from extending to the labial margin. In all other members of the family, a single scale called the oculolabial (ocular of Klauber 1940) covers the eye and extends to the labial border. The two original species in the group also had a similarly striped color pattern. The three new species described herein are members of the *bilineatus* group that depart significantly in certain features from *L. bilineatus* and *L. pyrites.*

We continue to use the term "*bilineatus* group" as a convenient means of designating those species of *Leptotyphlops* having the subocular supralabial scales. That all of the known members are restricted to the West Indies suggests that we may be dealing with a monophyletic radiation. However, it is also possible that the group is non-monophyletic and represents remnants of an old, formerly more widespread group within the genus, whose only relicts happen to be West Indian. Following this interpretation, the presence of subocular supralabial scales could well be a plesiomorphous character. An osteological study under way (Thomas) may clarify relationships within the genus and shed light on the nature of the *bilineatus* group.

Methods and Terminology

We use certain conventions of description and measurement that should be noted.

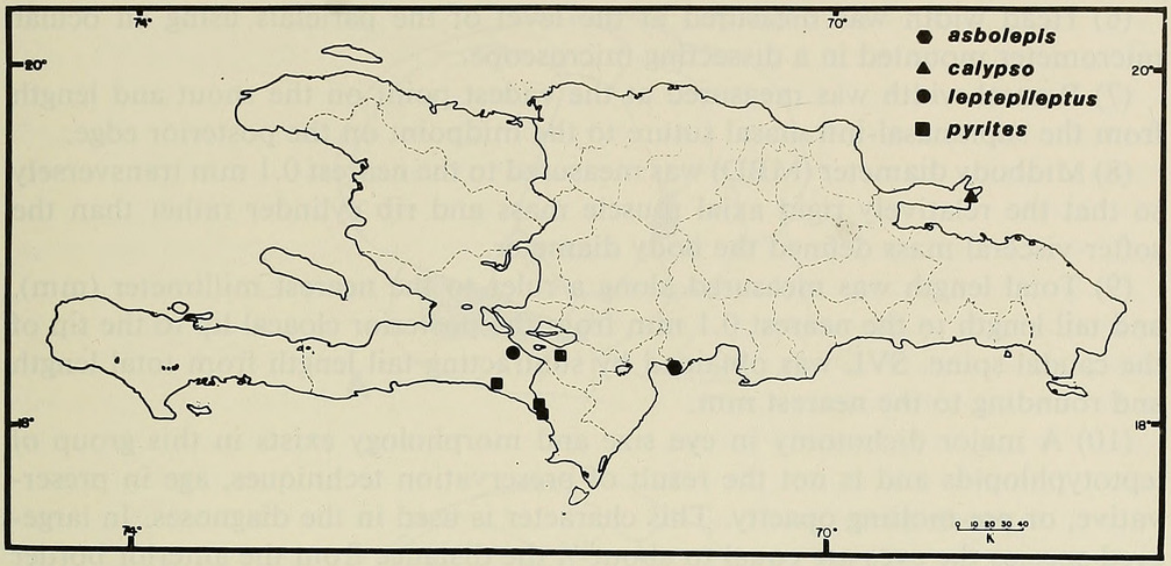

Fig. 1. Map of Hispaniola showing localities for *Leptotyphlops* species.

(1) With reference to most scales, length refers to the greatest anterior-posterior measurement, and width refers to the greatest transverse measurement, even if the transverse dimension is the greater. When this convention is not used, as with a diagnonally placed scale, the "length" is measured along the major axis and is so stated. Height is the greatest vertical measurement when the surface of the scale is largely lateral. All measurements were made with dial calipers unless otherwise noted.

(2) Supranasal and infranasal scales are equivalent to upper and lower nasals as used by Klauber (1940). Prefrontal, frontal, interparietal, and interoccipital in some instances are designated PF, F, IP, and IO, respectively.

(3) When the rostral is described as protuberant, it has a distinct central bulge, i.e., in transverse section the edges of the rostral scale would be seen to lie flat against adjacent scales and the central part to arch outward (Fig. 2). The resulting dorsal outline of the head may be almost trilobed. An extreme of protuberance is seen in the ogival outline of the head of *Rhinoleptus* (Orejas-Miranda *et al.* 1970, figs. 2 and 3). The protuberance we describe does not result from a pre-shedding condition such as has been seen in some typhlopids (Richmond 1961).

(4) A decurved snout describes a condition in which the ventral surface of the snout is straight (horizontal), or even slightly concave, and the bulge in the rostral drops slightly below this plane.

(5) Scale row reductions are described in two ways. First, the number of mid-ventral scales anterior to the anal scale was recorded at the point at which scale rows fuse. Scale rows were counted left to right and ventral to dorsal with the midventral row being 0; thus one could have a reduction formula of 20 (2 + 3)/16 (2 + 3). Second, the distance in millimeters (Z) anterior to the vent was measured at the last reduction step (13 rows to 12 rows at ventral 16). The point of reduction is then expressed as a percentage of snout-vent length (SVL) computed by $[1 - (Z/SVL)] \times 100$. This is much more informative than standard scale row reduction formulae, which are of dubious comparative value when longitudinal counts differ.

(6) Head width was measured at the level of the parietals using an ocular micrometer mounted in a dissecting microscope.

(7) Rostral width was measured at the widest point on the snout and length from the supranasal-infranasal suture to the midpoint on the posterior edge.

(8) Midbody diameter (MBD) was measured to the nearest 0.1 mm transversely so that the relatively rigid axial muscle mass and rib cylinder rather than the softer visceral mass defined the body diameter.

(9) Total length was measured along a ruler to the nearest millimeter (mm), and tail length to the nearest 0.1 mm from the posterior cloacal lip to the tip of the caudal spine. SVL was obtained by subtracting tail length from total length and rounding to the nearest mm.

(10) A major dichotomy in eye size and morphology exists in this group of leptotyphlopids and is not the result of preservation techniques, age in preservative, or pre-molting opacity. This character is used in the diagnoses. In large-eyed species the eyes are equal to about ⅓ the distance from the anterior border of the naris to the posterior margin of the eye; they are close to the surface and are surrounded by a distinct, clear orbital space. The ocular scale bulges slightly outward over the orbit, and that area lacks scale organs. In the small-eyed species the eye is about ⅛ the naris-to-eye distance and visible only as a small black dot well beneath the scale surface. There is no evident orbital space nor brille-like differentiation of the ocular. Scale organs are randomly distributed over the surface of the ocular.

(11) All scale organs that we discerned in these leptotyphlopids are small tubercles, some more flattened than others (flattening is probably an artifact of preservation). Orejas-Miranda *et al.* (1977) showed that differences in the density of scale organs on the heads of some leptotyphlopids may be of taxonomic value. We did not count scale organs because among the new species no great variation in scale organ density was observed. The species we describe have scale organs scattered over the head. They are concentrated on the snout and infralabials, become sparse on the posterior head region, and are largely absent behind the parietals. The scale organs appear to be more numerous in the large-eyed, heavily pigmented members of the group (*bilineatus* and *pyrites*) than in the new species.

(12) All specimens were sexed; if hemipenes were not everted, sex was determined by dissection of hemipenes or dissection of gonads.

(13) Data for holotypes listed in [ ] in description sections for each species.

(14) Statistics were done on an Apple computer using the program "Quickstat" by C. Richard Tracy.

Specimen citations reference the following museums: UF—University of Florida, Florida State Museum; USNM—National Museum of Natural History. Some additional specimens in the collection of Richard Thomas (RT) and in the Albert Schwartz Field Series (ASFS) will be deposited in other museums.

Leptotyphlops calypso, new species

Figs. 2, 3

Holotype.—USNM 236659, adult male, taken 6.5 km S Las Galeras, Provincia de Samaná, Dominican Republic, on 22 Feb 1975, by Roy W. McDiarmid.

Paratypes.—(all from Provincia de Samaná, Dominican Republic). RT 8859,

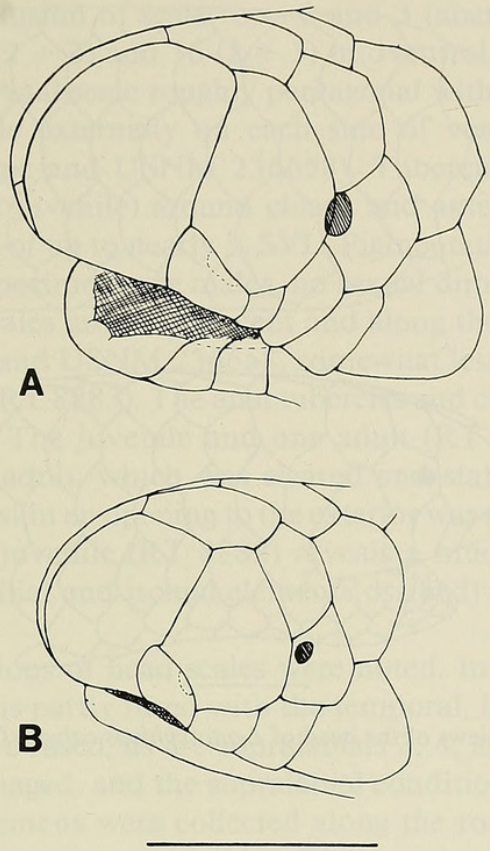

Fig. 2. Anterolateral view of the heads of A, *Leptotyphlops calypso* (USNM 236658, paratype) and B, *L. leptepileptus* (ASFS V49850, paratype) showing differences in snout and rostral shape. Line = 1 mm.

USNM 236658, adult males, ca. 4 km S Las Galeras, 8 Aug 1981, R. Thomas.—RT 8883, juvenile male, ca. 5 km S Las Galeras, 12 Aug 1981, Sra. Matías.

Diagnosis.—A relatively slender (SVL/MBD 73–87), unpigmented (pink in life), small-eyed *Leptotyphlops* of the *bilineatus* group having 4 supra- and 4 infralabials, third supralabial in subocular position; high number of middorsal scales (370–380); far posterior reduction from 14 to 12 scale rows (96–97% SVL) by fusion of rows 2 and 3; rostral moderate; snout broadly rounded, not protuberant; supranasal rhomboidal; ocular small, hexagonal; temporal-parietal suture length equal to ½ or less the parietal-occipital suture; anal and ventral tubercles in males; external anal spurs in at least some males; pelvic girdle including ilium, ischium, pubis and femur present.

Distribution.—Known only from the area between 4 and 6.5 km S Las Galeras on the Samaná Peninsula of the Dominican Republic (Fig. 1).

Description.—(all specimens male, N = 4) (Figs. 2 and 3, Tables 1 and 2). SVL 124–190 [166] mm ($\bar{x}$ = 166.5 mm); tail 5.8–8.9 [7.7] mm ($\bar{x}$ = 7.8 mm); MBD 1.7–2.2 [1.9] mm ($\bar{x}$ = 2.0 mm); SVL/MBD 73–87 [87] ($\bar{x}$ = 82.8). Head parallel-sided, tapering anterior to slight temporal bulge (head width 1.88–2.14 mm; $\bar{x}$ = 2.001 mm); snout somewhat truncate in dorsal aspect, broadly rounded in lateral aspect with nearly vertical anterior face, not protuberant or decurved. Eye small (equal to ⅙ to ⅛ distance from anterior border of naris to posterior border of eye), deeply embedded, no clear orbital space. Rostral moderate in width, parallel-

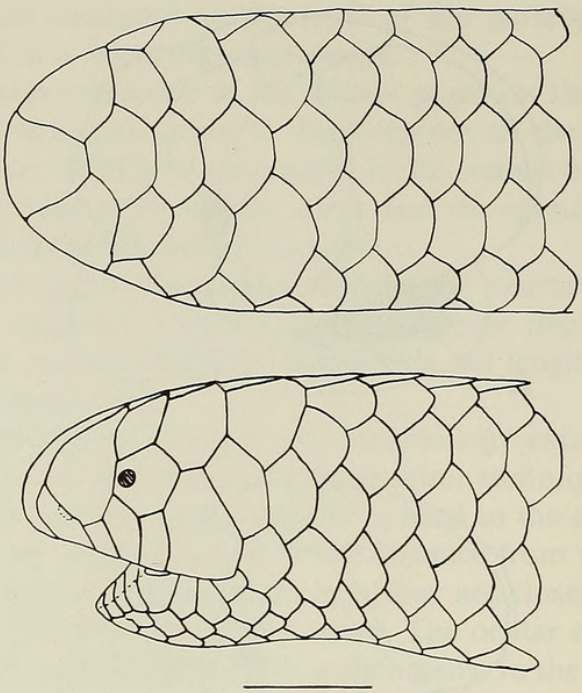

Fig. 3. Dorsal and lateral views of the head of *Leptotyphlops calypso* (RT 8859, paratype). Line = 1 mm.

sided ventrally, expanding slightly on tip of snout and tapering posteriorly to a narrow, truncate margin; virtually all of rostral visible in frontal view. Prefrontal large, hexagonal, slightly broader than long; frontal smaller, hexagonal, distinctly broader than long; interparietal larger (PF > IP > IO > F). Supranasal roughly rhomboidal, narrowest dorsomedially, broadly curved on posteroventral edge, not angled; ventralmost point a broad wedge between infranasal and first supralabial. Infranasal large, mostly visible in lateral view, extending dorsally to a level just below eye; free edge extending from widepoint of rostral posteroventrally, suturing with supranasal and first supralabial; naris under edge of infranasal just anterodorsal to supranasal-first supralabial suture. Ocular small, hexagonal, about 1.3 times higher than long, with a short supranasal suture. Supraocular large, elongate, about twice as long (major axis) as wide, pentagonal, almost a parallelogram, extending ventrally to just above eye. Parietal and occipital large and blocklike, occipital larger than parietal; both about 1.6 times wider than long and spanning two paramedian scale rows; occipital slightly emarginate on distal free edge. Temporal inserting between parietal and occipital for distance equal to ½ or less the length of parietal-occipital suture. Four supralabials, first suturing dorsally with supranasal, second picketlike with dorsal apex inserted between supranasal and ocular, third abutting dorsally on ocular, fourth large and subtriangular, most of its area posterior to ocular, in contact with posteroventral edge of ocular, parietal, temporal, and first scale of dorsal row 3. Mental scale with median ventral notch, each winglike lobe extending posterolaterally inside labial margin along posterior median edge of first infralabial; postmental cycloid. Infralabials 4, the fourth large, oval, platelike. Middorsal scales 375–380 [379] ($\bar{x}$ = 377.5); subcaudal scales 19–20 [20] ($\bar{x}$ = 19.5). Scale rows 14, reducing to 12 at

96–97% [96] SVL by fusion of scale rows 2 and 3 (aberrantly 3 and 4 on right side of RT 8883) [20 (2 + 3) and 16 (2 + 3) midventral scales anterior to vent]; caudal scale rows 12. Anal scale roughly pentagonal with posterior median apex. Prominent spur visible externally on each side of vent beneath scale in two specimens (the holotype and USNM 236658). Tubercular scale organs present (except in RT 8883, a juvenile) around cloaca and anteriorly on 3 ventralmost scale rows for distance of up to nearly ⅓ SVL. Pigmentation lacking (pink in life).

Variation.—As all specimens are males, no sexual dimorphism is evident. The tuberculation of the scales around the vent and along the ventral surface is most extensive in RT 8859 and USNM 236658, somewhat less so in the holotype, and absent in the juvenile (RT 8883). The anal tubercles and claws likely are secondary sexual characteristics. The juvenile and one adult (RT 8859) lacked externally visible spurs, but the adult, which was cleared and stained, has internal spurs. During removal of the skin an opening to the exterior was evident. An examination of radiographs of the juvenile (RT 8883) reveals a much less developed pelvic girdle rudiment (only ilial and ischial elements ossified) and no obvious internal spurs.

Some abnormal fusions of head scales were noted. In the holotype the fourth supralabial on the left is partly fused with the temporal. In RT 8883, supralabials 1 and 2 on the right are fused, as are supralabials 3, 4, and the temporal; the left side of the head is damaged, and the supralabial condition cannot be ascertained.

Remarks.—All specimens were collected along the road south of Las Galeras that parallels a prominent limestone ridge. The area is a mixture of open pasture and mixed mesic cultivation (bananas, yams, coffee, corn, coconuts, papayas) interspersed with some scrubby to semi-wooded habitat. The holotype and two other specimens (RT 8859, USNM 236658) were taken from beneath very large limestone rocks in an open pasture; a third specimen was beneath the same rock with one of the paratypes but escaped. The juvenile was found crawling on the floor of an outdoor kitchen.

Etymology.—*Calypso* is a proper noun that derives from the Greek verb "to hide" (*kalypto,* "I hide"); this new species is certainly well hidden in nature, as those of us who have looked for it can attest. Furthermore, Calypso, the nymph who sequestered Odysseus on Ogygia, was in island creature; and calypso, as a music form, has West Indian associations, even if not in the Hispaniolan traditions.

Leptotyphlops asbolepis, new species
Fig. 4

Holotype.—UF 54802, adult female, taken on the west slope of Loma del Aguacate, 350 m, Sierra Martín García, Provincia de Barahona, Dominican Republic, on 29 Jan 1976, by Fred G. Thompson.

Paratype.—USNM 236660, adult male, same data as holotype.

Diagnosis.—A relatively stout (SVL/MBD 56–60), small-eyed, uniformly pigmented *Leptotyphlops* of the *bilineatus* group having 4 supra- and 4 infralabials, third supralabial in subocular position; relatively low middorsal scale number (302–342); far posterior reduction from 14 to 12 scale rows (98–99% SVL) by fusion of rows 2 and 3; rostral moderate in size; snout slightly decurved and protuberant; rhomboidal supranasal; small to large, hexagonal ocular; temporal-

parietal suture length equal to or slightly less than length of parietal-occipital suture; no anal or ventral tubercles; no anal spurs; no pelvic girdle.

Distribution.—Known only from the type locality (Fig. 1).

Description.—(Fig. 4, Tables 1 and 2). SVL 135–[156] mm; tail 6.6–[6.8] mm; MBD 2.3–[2.5] mm; SVL/MBD 56–[60]. Head slightly broader than neck (1.97–2.01 mm; $\bar{x}$ = 1.99 mm), tapering towards snout from slightly swollen temporal region; snout somewhat protuberant, rounded in lateral aspect, slightly decurved. Eye small (equal to ca. ⅛ distance from anterior edge of naris to posterior margin of eye), deeply embedded, no clear orbital space. Rostral moderately wide, parallel-sided ventrally, expanding on tip of snout, where slightly protuberant, and tapering to truncate posterodorsal margin; ventral portion nearly horizontal. Prefrontal, frontal, and interparietal subhexagonal, wider than long, increasing in size in that order; interoccipital smaller than interparietal, cycloid, isomorphic with succeeding middorsal scales. Supranasal roughly rhomboidal, narrowest dorsomedially, broadly curved on posteroventral edge, not angled, ventralmost point a broad wedge between infranasal and first supralabial. Infranasal large, mostly visible in lateral aspect, extending dorsally to point just above level of eye; posterior edge extending from wide point of rostral posteroventrally, contacting supranasal and first supralabial; naris under edge of infranasal about midway along infranasal-supranasal suture. Ocular small to large, about 1.2 to 1.6 times higher than long, hexagonal, with long supranasal suture. Supraocular small, a short pentagon, about 1.5 times longer (major axis) than wide, extending ventrally to point well above eye. Parietal and occipital large, about twice as wide as long, each spanning 2 dorsal scale rows; parietal somewhat emarginate on distal free edge; occipital markedly to moderately emarginate. Temporal inserted between parietal and occipital a distance greater than ½ parietal-occipital suture. Four supralabials, second picketlike with dorsal apex inserted between supranasal and ocular, third abutting dorsally on ocular, fourth large and subtriangular, most of its area posterior to ocular, in contact with posteroventral edge of ocular, parietal, temporal, and first scale of row 3. Mental with median ventral notch, each winglike lobe extending posterolaterally inside labial margin along posterior median edge of first infralabial; postmental cycloid. Infralabials 4, fourth large, oval and platelike. Middorsal scales 302–[342]; subcaudals [18]–19. Scale rows 14, reducing to 12 at 8 and 6 and [7 and 4] midventral scales anterior to vent at 98–[99]% SVL by fusion of rows 2 and 3; caudal scale rows [12]. Anal scale roughly pentagonal with posterior median apex. No anal spurs. Tubercular scale organs scattered over head, largely absent posterior to occipitals, concentrated on rostral and infralabials; no scale organs evident around vent. Pigmentation relatively uniform and dense over body but with some unpigmented patches; coloration faintly lineate due to slightly denser melanophores at centers of scales; head unpigmented, pigmentation beginning about level of occipitals.

Variation.—The difference of 40 middorsal scales between the type and the paratype is probably the result of sexual dimorphism, as is also the relative difference in tail length (see following description for evidence on sexual dimorphism in these snakes). The other main difference between the type and the paratype is in the size of the ocular scale. Because sexual dimorphism in this character is unknown in other species of *Leptotyphlops*, most likely this represents extremes of variation.

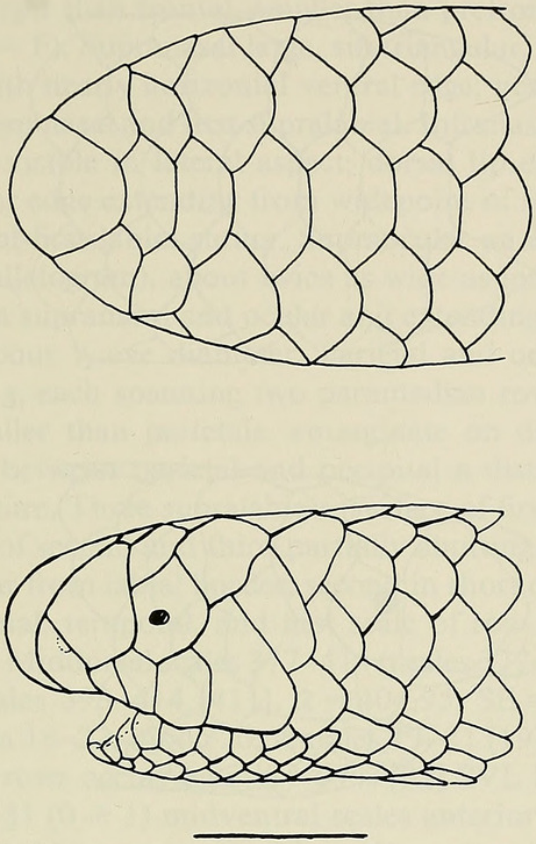

Fig. 4. Dorsal and lateral views of the head of *Leptotyphlops asbolepis* (UF 54802, holotype). Line = 1 mm.

Remarks.—The two specimens of *L. asbolepis* were collected under limestone boulders in a mesic forest zone reached by trail up the mountainside from La Salina (Puerto Alejandro) on the east side of the Bahia de Neiba.

Etymology.—From the Greek, *asbolos,* "soot," and *lepis,* "scale," in reference to the darker, more uniform coloration of this species.

Leptotyphlops leptepileptus, new species
Figs. 2, 5

Holotype.—USNM 236661, adult female, taken at Soliette, 5 km airline NW Fond Verettes, 366 m, Département de l'Ouest, Haiti, one of series collected on 19 Jul 1978, by native collectors and Richard Thomas.

Paratypes.—(all same locality as holotype) RT 5596, juvenile male, 5614, female, 19 Jul 1978, native collectors and Richard Thomas.—RT 5682–5685, 5696–5715, USNM 236662–71, 19 males, 15 females, native collectors, 23 Jul 1978.—ASFS V49834–70, 13 males, 23 females, 1 undetermined, native collectors, 13 Jul 1979.

Diagnosis.—Relatively slender (SVL/MBD 72–94), small-eyed, silvery tan or piebald *Leptotyphlops* of the *bilineatus* group having 3 supra- and 3 infralabials, second supralabial in subocular position; high number of middorsal scales (377–

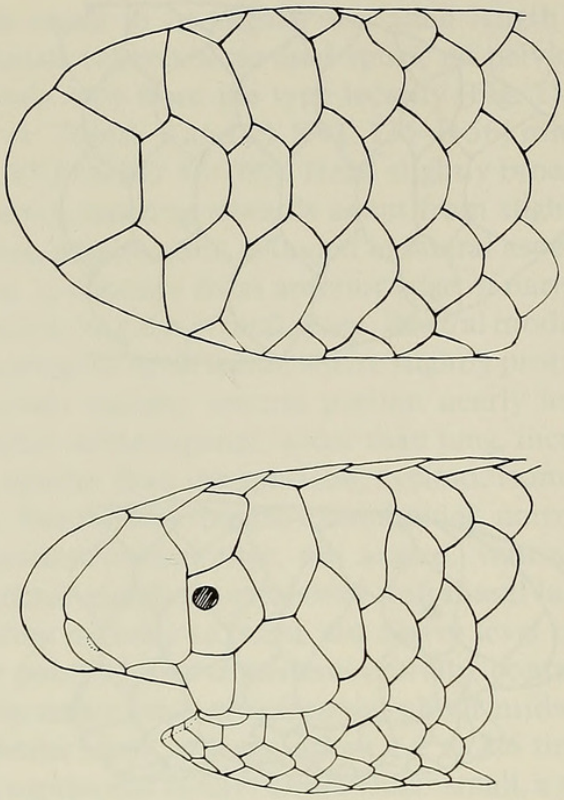

Fig. 5. Dorsal and lateral views of the head of *Leptotyphlops leptepileptus* (USNM 236661, holotype). Line = 1 mm.

414); far posterior reduction from 14 to 12 scale rows (84–95% SVL) by fusion of rows 0 and 1; large, protuberant rostral; slightly decurved snout; triangular supranasal; small, pentagonal ocular; temporal-parietal suture length equal to ½ or less length of parietal-occipital suture; no anal or ventral tubercles; no anal spurs; pelvic vestiges usually absent.

Distribution.—Known only from the type-locality, an intermontane valley on the north slopes of the Massif de la Selle of Haiti (Fig. 1).

Description.—(Figs. 2 and 5, Tables 1 and 2). SVL: males (juveniles of 102, 105 mm excluded) 144–174 mm, $\bar{x}$ = 156.03 mm, SE = 2.548 mm (N = 29); females 140–198 [184] mm, $\bar{x}$ = 172.88 mm, SE = 4.275 mm (N = 41); tail length: males 5.0–7.4 mm, $\bar{x}$ = 6.80 mm, SE = 0.013 mm (N = 32); females 5.8–7.4 [7.1] mm, $\bar{x}$ = 6.87 mm, SE = 0.008 mm (N = 40); MBD 1.4–2.3 [2.1] mm, $\bar{x}$ = 1.99 mm, SE = 0.176 mm (N = 74); SVL/MBD 72–94 [87.6]. Head narrow (1.45–1.68 mm, $\bar{x}$ = 1.60 mm, SE = 2.121 mm, N = 72), parallel-sided with slight temporal bulge, tapering anterior of eyes to somewhat protuberant, decurved snout. Eye small (⅙ to ⅛ distance from naris to eye), deeply embedded, no clear orbital space. Rostral large, covering about ½ snout anterior to eye in dorsal aspect, tapering posteriorly to truncate margin, protuberant on snout tip; parallel-sided ventrally, widening gradually onto front of snout; ventral portion horizontal, somewhat concave, not completely visible in frontal view. Prefrontal very large, subhexagonal to nearly cycloid; frontal smaller (shorter), hexagonal; interparietal

and interoccipital larger than frontal, smaller than prefrontal, cycloid (in general PF ≥ = IP > IO ≥ = F). Supranasal large, subtriangular, posterior edge forming nearly right angle with nearly horizontal ventral edge; ventralmost point at apex of broad angle between nasal and first supralabial. Infranasal small, surface largely ventral, mostly not visible in lateral aspect; dorsal tip extending to just below level of eye; posterior edge extending from widepoint of rostral posteroventrally, contacting supranasal-first labial suture. Supraocular an elongate, irregular pentagon (almost a parallelogram), about twice as wide as long (major axis), ventral end inserted between supranasal and ocular and extending to point above eye for distance equal to about ½ eye diameter. Parietal and occipital large, less than twice as wide as long, each spanning two paramedian rows of dorsal scales; occipitals slightly smaller than parietals, emarginate on distal half of free edge. Temporal inserting between parietal and occipital a distance ⅓ to ½ length of parietal-occipital suture. Three supralabials, surface of first nearly ventral (transverse); dorsal edges of second and third partially abutting ventral edge of ocular, both occluding ocular from labial border; second in short contact with supranasal and third with parietal, temporal, and first scale of row 3. Infralabials 3, third large, oval, platelike. Middorsal scales 377–414 (males 377–395, $\bar{x}$ = 385.22, SE = 0.866, N = 32; females 393–414 [411], $\bar{x}$ = 404.95, SE = 0.773, N = 41). Subcaudals 17–22 (males 18–22, mode 20; females 17–21 [19], mode 20). Reduction from 14 to 12 scale rows occurring at 84–97% [92] SVL by fusion of scale rows 0 and 1 [31 (0 + 1)/31 (0 + 1) midventral scales anterior to vent]; scale rows of tail 12. Anal scale roughly pentagonal with median posterior apex. No anal spurs; no pelvic girdle, pelvic vestiges occasionally present. Head unpigmented; brown (silvery in life) body pigmentation beginning on neck and becoming uniform over all of body except anal scale; variant pigmentation (20%) with irregular unpigmented and more darkly pigmented blotches randomly distributed over body. Hemipenes simple, everted organs expanded basally, tapering towards tip, no ornamentation and no complex structures; size minute, about 1 mm long in largest specimens. Sulcus spermaticus entering organ on medial surface, proceeding distad about ½ length, then spiralling counterclockwise ¼ turn (apical aspect) and continuing to tip of organ.

Variation.—Pronounced sexual dimorphism exists in middorsal counts, SVL, tail length as a percentage of body length, and reduction level (% SVL). Differences between means of these characters were all significant at $P < 0.000001$ when tested with the t-test. Subcaudal counts have the same mode in both sexes, but the range of counts for males was higher than that for females. The piebald color morph occurs in both sexes. Variants from the standard configuration of head scales include a small, supernumerary scale separating the third supralabial from contact with the parietal (USNM 236662 bilateral; RT 5705, right side), the wedge-insertion of the second supralabial between the ocular and supranasal (ASFS V49854, left side), and 4 supralabials (bilateral) in USNM 236662, although in this specimen the second supralabial does not insert between the supranasal and the ocular, as it does in the species of this group for which four supralabials is the normal condition. Only one of 35 x-rayed and two cleared and stained specimens had a trace of a pelvic rudiment. In that male (RT 5713) a pair of small, opaque elements (ischial remnants?) lying lateroventrally below the second vertebrae anterior to the cloaca is obvious in the radiograph. None of the hemipenes

appears completely everted, although many are nearly so; they are minute, none measuring more than 1 mm in length.

Remarks.—The type-locality is a settlement along the valley of the Rivière Soliette, tree-lined and shady compared to the more open cultivation-scrub mosaic of the surrounding limestone hills. Some specimens were collected from piles of stream-worn cobbles in a shady (mango) rest area along the road. Unfortunately, we have no way of knowing how far away and into what different habitats, if any, the Haitian collectors ranged to collect the balance of the specimens.

Etymology.—*Leptepileptus* is from the Greek meaning extremely thin, literally "thin-upon-thin."

Comparisons and Discussion.—The three species we describe obviously are more closely related to one another than to the other two species within the *bilineatus* group. They are small-eyed, small-headed, relatively long-snouted, slender, lightly (or not at all) pigmented snakes with high numbers of middorsal scales and scale row reduction occurring on the body. In contrast, *Leptotyphlops bilineatus* and *L. pyrites* are shorter, stouter, larger-headed, larger-eyed, shorter-snouted, boldly patterned snakes with lower middorsal scale counts and no scale row reduction on the body. Among our trio of new species, the differences are nevertheless pronounced. *Leptotyphlops leptepileptus* has a strikingly narrower head (Fig. 6) and broader rostral scale (Fig. 7); it also is unique among the three in having three supra- and infralabial scales and a scale row reduction by fusion of rows 0 and 1. The large, triangular, last supralabial (3 in *leptepileptus,* 4 in *calypso* and *asbolepis*) partly extends beneath the ocular in *L. leptepileptus,* whereas its area is largely posterior to the ocular in *L. calypso* and *L. asbolepis.* In *L. leptepileptus* the rostral is larger and more protuberant, and the snout is more decurved and depressed (more transversely oval in cross section); as a reflection of this, the infranasal and first supralabial are more nearly transverse in position than they are in the other two species. The ocular distance is notably shorter in *L. leptepileptus* (Fig. 8). The lateral head scale differences between *L. leptepileptus* and the other species are largely attributable to the lack of equivalent supralabials. The second supralabial in the 4-labial species inserts wedge-like between the supranasal and the ocular and accounts for the more rhomboidal shape of the supranasal by putting an extra facet on the posteroventral margin of the supranasal. Likewise the ocular becomes more hexagonal by the second supralabial insertion. The large, triangular, last supralabial is largely excluded from the subocular space in the 4-labial species but occupies part of the sub-ocular space in *L. leptepileptus.* Therefore, the differences are not easily viewed as the result of simple fusion of one supralabial with another to get from the 4- to the 3-supralabial condition (or simple splitting, if the reverse was the sequence). Other aspects of shape differences among the species are obvious by comparison of Figs. 3, 4, 5, and 9 and Table 1.

The absence of pelvic vestiges in *L. asbolepis* and most *L. leptepileptus* is a feature undocumented in other species of the genus (List 1966), although Tihen (1945) reported a personal communication from Leonard Laufe that some (unspecified) species lack them. Examination of three specimens of *L. bilineatus* (USNM 119168 and USNM 222954, radiographs; USNM 236657, cleared and stained) and one specimen of *L. pyrites* (RT 7600, cleared and stained) failed to reveal pelvic vestiges in these species as well. Based on our preliminary findings, it appears that the *bilineatus* group has species which clearly document an evo-

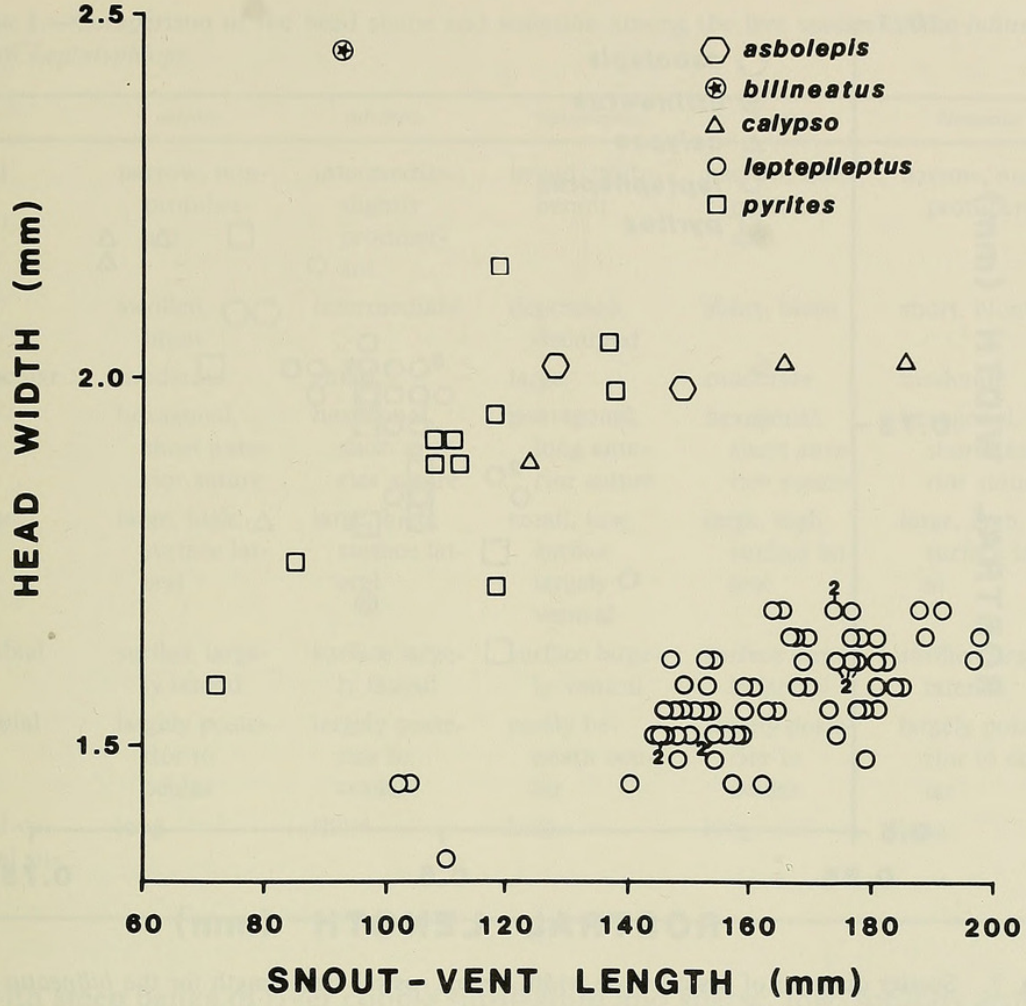

Fig. 6. Scatter diagram of head width versus snout–vent length for *bilineatus* group *Leptotyphlops*. Numbers indicate symbols representing more than one specimen.

lutionary transition including forms with well developed pelvic girdles and external anal spurs (*L. calypso*), species in which a pelvic vestige is only rarely present (*L. leptepileptus*), and species which seemingly lack pelvic vestiges completely (*L. asbolepis, L. bilineatus, L. pyrites*). A comparison of the single juvenile of *L. calypso* to adults of that species indicates a sequential pattern of ossification of the pelvic girdle with posterior elements (ilium and ischium) appearing before the anterior and lateral components. Thus, one can envision a reduction and ultimate loss of pelvic girdle components in West Indian species of *Leptotyphlops* through modification of the developmental process. This interpretation is strengthened by the detection of an ossified ischial vestige in only one specimen of *L. leptepileptus* whereas all others (36) examined have lost the girdle completely. These findings suggest the value of a detailed examination of the sexual and ontogenetic changes in pelvic girdle components during development and growth of *Leptotyphlops*.

Leptotyphlops calypso has a more rounded and swollen snout with an almost flat, ramlike anterior surface but narrow rostral. The prominent perianal and ventral tubercles in *L. calypso*, if consistent (presumably in adult males only), are

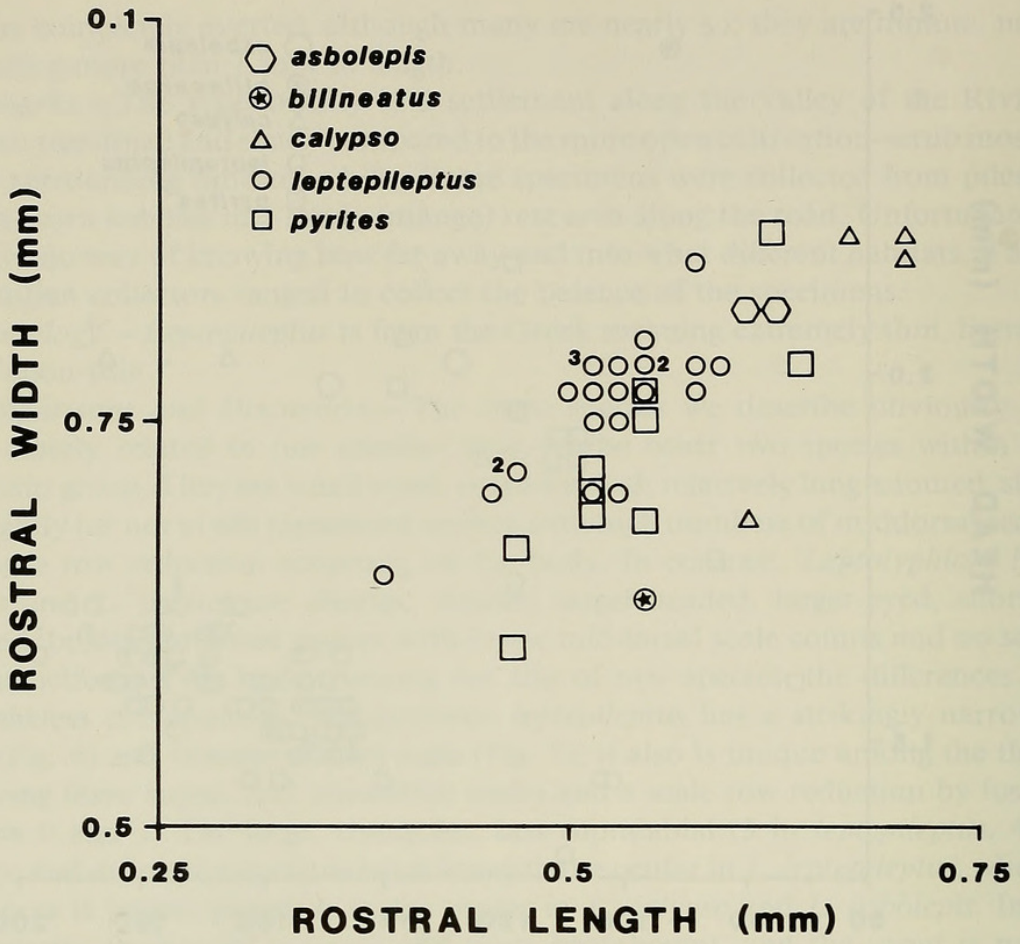

Fig. 7. Scatter diagram of rostral scale width versus rostral scale length for the *bilineatus* group *Leptotyphlops*. Numbers indicate symbols representing more than one specimen.

probably unique (the small sample of *L. asbolepis* precludes our being sure). Since we have but one male *L. asbolepis,* we also cannot be sure that anal spurs do not exist in that species. However, the absence of a pelvic vestige in *L. asbolepis* suggests that anal spurs may be absent. The claws reported for *L. humilis* and *L. nigricans* by List (1955) seem much less well developed than those of *L. calypso.* List noted the possibility that claws emerge to the surface during the breeding season only.

Leptotyphlops asbolepis, although amply distinct in combination of characters (Tables 1 and 2), lacks strikingly unique features; it is the most darkly pigmented of the three and is intermediate in rostral size and snout shape between *L. calypso* and *L. leptepileptus.* The extent to which the temporal inserts between the parietal and occipital is very distinctive, and the supraocular is also small compared to that of the other species.

One result of our collecting has been the acquisition of more material of *Leptotyphlops pyrites.* Originally known only from the xeric to semixeric lowlands of the western Barahona Peninsula of the Dominican Republic, we now have taken it in the southeastern coastal plain of Haiti. The habitat at the localities east of Belle-Anse is xeric limestone scrub and remnant woods, similar to some of the area near the type-locality. At Mare Geoffrey, 19 km W Thiote, the habitat is more mesic. At this locality the road crosses a dry (no doubt intermittent) river

Table 1.—Comparison of the head shape and scalation among the five species of the *bilineatus* group of *Leptotyphlops*.

	calypso	*asbolepis*	*leptepileptus*	*pyrites*	*bilineatus*
Rostral	narrow, non-protuberant	intermediate, slightly protuberant	broad, protuberant	narrow, non-protuberant	narrow, non-protuberant
Snout	swollen, blunt	intermediate	depressed, decurved	short, blunt	short, blunt
Supraocular	moderate	small	large	moderate	moderate
Ocular	hexagonal, short anterior suture	hexagonal, short anterior suture	pentagonal, long anterior suture	hexagonal, short anterior suture	hexagonal, short anterior suture
Infranasal	large, high; surface lateral	large, high; surface lateral	small, low; surface largely ventral	large, high; surface lateral	large, high; surface lateral
First labial	surface largely lateral	surface largely lateral	surface largely ventral	surface largely lateral	surface largely lateral
Last labial	largely posterior to ocular	largely posterior to ocular	partly beneath ocular	largely posterior to ocular	largely posterior to ocular
Parietal-occipital suture	long	short	long	long	long

bed with steep banks of river cobble substratum and sparse, low, scrubby growth with some trees. We found seven *L. pyrites* together in loose soil and gravel around the roots of a small leguminous tree; two others were found in somewhat more exposed situations, one under a rock and one in a piece of abandoned termite

Table 2.—Comparison of major diagnostic characteristics among the five species of the *bilineatus* group of *Leptotyphlops*.

	calypso	*asbolepis*	*leptepileptus*	*pyrites*[1]	*bilineatus*
SVL-maximum (mean)	190 (167)	156 (146)	198 (164)	138 (115)	108 (90)
SVL/MBD	73–87	56–60	72–94	43–64	35–41
Middorsals	370–380	302–342	377–414	262–287	170–189
Reduction level (% SVL)	96–97	98–99	84–95	—[2]	—[2]
Rows fused in reduction	2 + 3	2 + 3	0 + 1	—[2]	—[2]
Labials	4	4	3	4	4
Eye size	small	small	small	large	large
Color	unpigmented	uniform except head	uniform or piebald except head	dark with stripes	dark with stripes
Anal spurs	+	–	–	–	–
Anal tubercles	+	–	–	–	–

[1] Data in part from Thomas (1965).
[2] Reduction occurs posterior to vent.

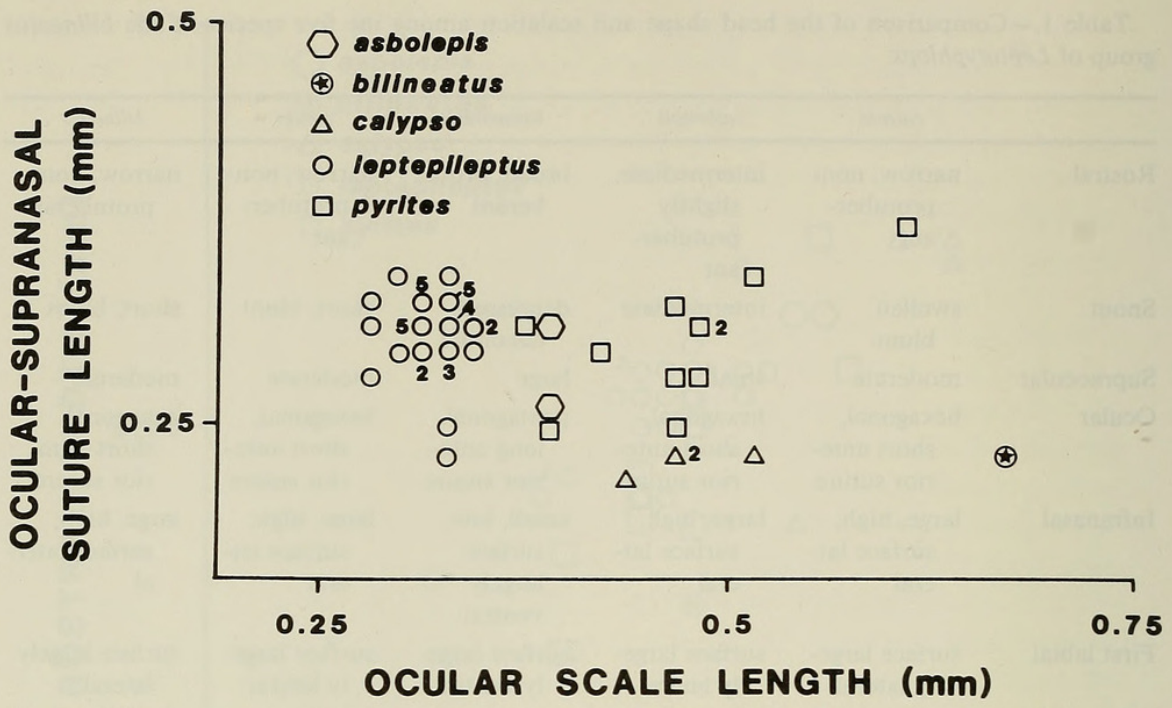

Fig. 8. Scatter diagram of length of the ocular-supranasal suture versus maximum length of ocular scale for the *bilineatus* group *Leptotyphlops*. Numbers indicate symbols representing more than one specimen.

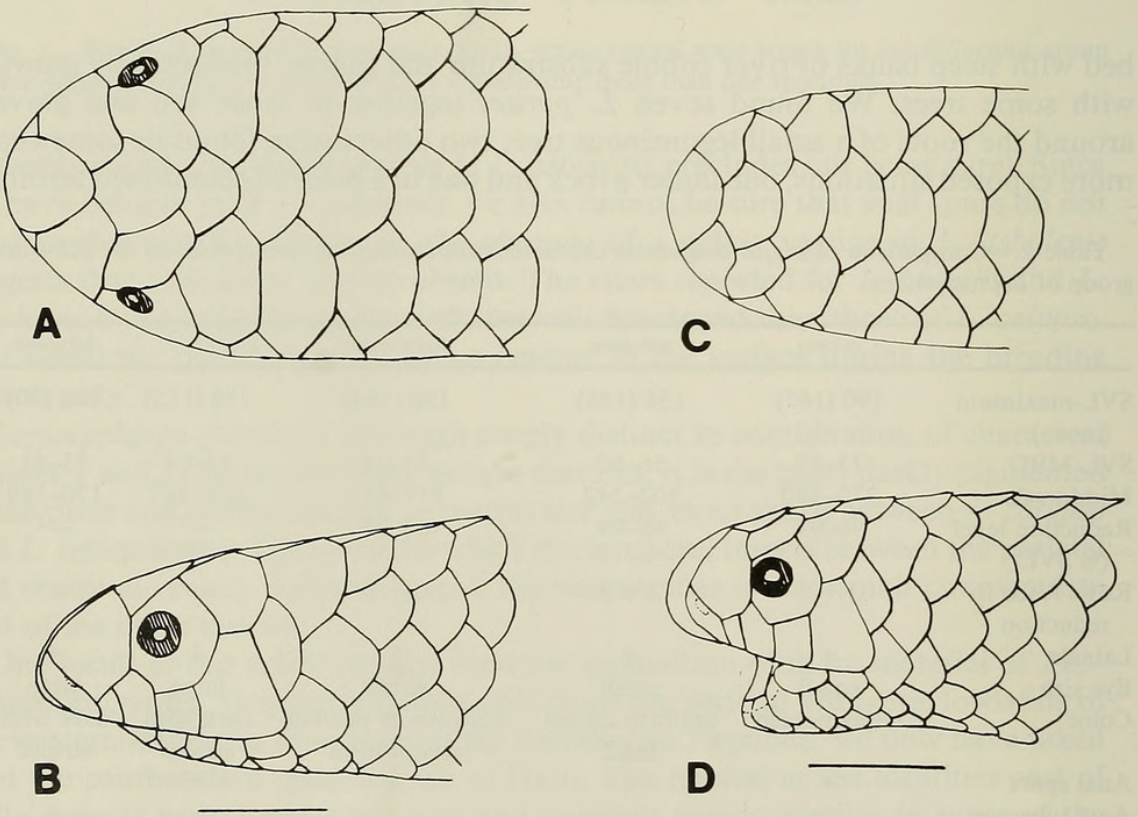

Fig. 9. Dorsal and lateral head views of *Leptotyphlops bilineatus* (A and B, USNM 236657) and *L. pyrites* (C and D, RT 7607). Line = 1 mm.

nest under a rock. Three specimens from 6 km NW Duvergé in the Valle de Neiba (Dominican Republic) extends the known range about 50 km to the northeast of the type-locality and across the Sierra de Baoruco. At this locality the habitat was extremely xeric; the snakes were found under palm trunk cuttings.

In meristic characters none of the new *L. pyrites* material departs significantly from those of the hypodigm, although one Duverge specimen (RT 4423) is at the upper extreme in middorsal scales (287). The Haitian specimens are darker than the Dominican specimens, the bold dorsal-zone striping being much obscured. In contrast, the three Valle de Neiba snakes lack the median and paramedian dorsal stripes, having only a pale median dorsal band. These individuals also appear to differ from topotypical *L. pyrites* in the shape and proportional relationships of certain head scales. Without more specimens the significance of this variation is difficult to assess.

Specimens examined.—*Leptotyphlops bilineatus,* Martinique: USNM 119168, Martinique: USNM 236657, Plage du Diamant.—St. Lucia: Anse-La-Raye: USNM 222954, 0.1 mi E of Anse Galet River. *Leptotyphlops pyrites,* Haiti: Département de l'Ouest: RT 7201, 9.6 km E Belle-Anse; RT 7222, 11.2 km E Belle-Anse; RT 7600–7608, RT 7692, 19.5 km W Thiote, 600′.—Dominican Republic, Provincia de Independencia: RT 4423 9125, 9126, 6 km W Duvergé.

Key to West Indian Speices of *Leptotyphlops*

1. Ocular scale excluded from labial border by supralabials 2
– Ocular (oculolabial) extends to labial border 6
2. Middorsal scales fewer than 290; eye large, obvious, equal to ⅓ distance from anterior border of naris to posterior margin of eye; striped color pattern 3
– Middorsal scales more than 300; eye small, indistinct, equal to ⅛ the distance from anterior border of naris to posterior margin of eye; generally uniform color pattern 4
3. Middorsal scales 170–189; small size, maximum snout–vent length 108 mm; known from Barbados, Martinique and St. Lucia ..... *bilineatus*
– Middorsal scales 262–287; medium size, maximum snout-vent length 138 mm; known from several localities on southern coastal plain of Hispaniola ..... *pyrites*
4. Three labial scales; middorsal scales 377–414; scale row reduction by fusion of rows 0 + 1; known only from the Massif de la Selle in Haiti ..... *leptepileptus*
– Four labial scales; middorsal scales fewer than 380; scale row reduction by fusion of rows 2 + 3 5
5. Middorsal scales 302–342; body uniformly pigmented; anal tubercles and spurs absent; known only from the Sierra Martín García, Dominican Republic ..... *asbolepis*
– Middorsal scales 370–380; body unpigmented; anal tubercles and spurs present in most males; known only from the tip of the Samaná Peninsula, Dominican Republic ..... *calypso*
6. Uniformly dark above, no light spot on snout or tail tip; known only from Watling Island (=San Salvador), Bahamas ..... *columbi*

– Usually with longitudinal dark stripes on each dorsal scale row, distinct light spot on snout and tail tip; known from Bay Islands of Honduras, Swan Islands, Providence and San Andres Islands ..... *goudotii*

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