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THE *SPHAERODACTYLUS* (SAURIA: GEKKONIDAE)  
OF SOUTH AMERICA

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INTRODUCTION

The Neotropical lizard genus *Sphaerodactylus* has radiated extensively in the Caribbean, where 68 species, and an additional 63 subspecies are currently recognized (Kluge, pers. comm.). In sharp contrast, few *Sphaerodactylus* are known from the mainland, with the majority of those ranging from southern México to Panamá (eight species). The generic name *Sphaerodactylus* has been associated with only nine South American taxa. Three of these have been referred to the closely related *Coleodactylus*, and of the remaining six, only three, *S. lineolatus*, *S. molei* and *S. scapularis*, are currently cited as valid (Peters and Donoso-Barros, 1970). An acute lack of any recent review of the South American situation for this genus came to my attention when attempting to discover relationships of a seemingly new sphaerodactyl from the Ciénaga Grande region. Such a review, mainly of systematics, but also covering geographic distribution and some aspects of ecology of the group, is provided in what follows.

METHODS

Measures and counts were done using a 10-30 power stereoscope. Snout-vent length (SVL) and length of undamaged original tails were measured from specimens

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pinned straight in a wax-bottomed dish. Head length (ear to tip of snout), width and depth were measured, on hand held specimens to the nearest 0.1 mm with a vernier caliper. Size comparisons of body structures were done using needle-pointed calipers. Scales, except for scales around midbody, were counted on pinned specimens, aided by placing a cross hair in both oculars of the stereoscope. The median rows of dorsals and ventrals were counted between the levels of the extended limbs, posterior to the forelimb and anterior to the hindlimb. Because a middorsal zone of granules is difficult to detect and because samples of dorsolateral counts do not consistently show reduced variation compared to vertebral counts in the South American species, I have not followed King's (1962:5) dorsolateral counting method for "dorsal scales." Middorsal counts are used instead to maximize the difference from ventral counts. Dorsolateral counts are ca. 90% of middorsal counts. The internasal count is the minimum number of scales separating the supranasals, but not necessarily also touching the rostral as in the method of King (1962:4). A "standard distance" was defined as the narrowest width of the frontal bone between the orbits ("IQW" for interorbital width). This distance is compared to diagonal series of scales.

I have attempted to quantify the shape and length of the snout using several measures. The angle of the snout profile was measured by lining up an ocular cross-hair with each side of the muzzle, viewed from above, and then reproducing the angle onto paper and measuring it with a protractor to the nearest half degree. A camera lucida was also used for this. The degree of pointedness of the snout was determined from camera lucida drawings. When measured from a midpoint on a line between the ocular spines, the snouts of all the species considered were less than 80% of being perfectly pointed; the perfect point being that where lines, extended from the greatest straight edge of the sides of the snout, intersect. Thus, the snouts of the continental sphaerodactyls are all rounded compared with the Caribbean *S. oxyrhinus* whose snout exceeds 80% pointedness (from Plate 16: Fig. 2, in Barbour, 1921).

Statistics are presented in sequence as follows: "minimum"—"maximum" ( $\bar{x}$  = "mean,"  $s$  = "standard deviation,"  $N$  = "sample size").

All of the native South American species share the following characteristics: 1. The tips of the digits are expanded into disks and the claw is displaced laterally. 2. The pupil of the eye is a nearly round, vertical ellipse in preserved specimens. 3. The ventral scales are always thin, flat, smooth and strongly imbricate, except where they are developed into the glandular abdominal shield, or escutcheon, in males. Escutcheon scales are subimbricate. 4. Scales of the throat and chest are not keeled. 5. The rostral is flattened, dorsally, and sloping toward its rounded tip. 6. An extrabrillar fringe borders the anterior half of the eye (Fig. 1b). It is composed of two rows of slightly enlarged, imbricate scales. The superior scale of the inner of these rows has a soft, spine-shaped extension which is often damaged, and thus shortened or lost. The intact ocular spine is usually of modest size or short in the South American species. The scales of the extrabrillar fringe are separated from the spectacle by a row of smaller scales that become larger dorsally; the top scale of the row is spade-shaped, and curves upward against the ocular spine.

The presence of an escutcheon indicated that the specimen was male and probably an adult. Though Grant (1932:405) stated that newly hatched specimens have a visible escutcheon, I did not observe this in the species studied herein, nor did Menchel and Maderson (1975) in their study. I make the gross assumption that individuals without an escutcheon and exceeding the minimum male size are adult females. Two other

characteristics of adult males include enlargement of the tail base and the presence of a group of swollen granules lateral and posterior to the vent.

Institution abbreviations as used below are given in the Acknowledgements section.

### SPECIES ACCOUNTS

*Sphaerodactylus heliconiae* n. sp.  
Figs. 1b, 2a-d, 3a-c, and 5 (map)

**HOLOTYPE:** ICN 3225, a male collected on 20 October 1977 by D. M. Harris.

**TYPE LOCALITY:** Colombia: Magdalena; beside a canal connecting the Río Frío and Río Sevilla, 3 km east of Candelaria. 10°52'N; 74°15'W, below 25 m elevation.

**PARATYPES:** Males—MCZ 29699, UMMZ 171649 and 171652 (cleared and stained); females—ICN 3223, 3224, 3226, UMMZ 171650-51. MCZ 29699 was collected near Sevilla, 17 km SE of the type locality, in 1928 by P. Darlington. All other specimens were collected at the same time and place as the holotype.

**ETYMOLOGY:** The specific name derives from the genus of plant with which eight specimens of the type series were associated (*Heliconia*; Musaceae).

**DIAGNOSIS.**—A moderately large *Sphaerodactylus* attaining 31.2 mm SVL. Dorsal trunk scales minute, homogeneous, keeled, 62–80. Ventral count 34–44, averaging 54.7% of dorsal count. Scales around midbody 73–89. Parietal granules smooth. Supranasals two, anterior much larger (Fig. 1b); anterior supranasals separated by 2–3 small internasals. Rostral deeply notched behind, containing 1–3 small scales; with a short median cleft. Fourth supralabial lies below anterior half of eye; fourth infralabial below center of eye. Subcaudal scales widened, 4–5 times width of supracaudals; aligned in a median series. Escutcheon huge, occupying posterior third of venter, not extending onto thighs; composed of 94–154 scales. Males with strongly reticulated dorsum and orange head. Dorsum of females with longitudinal rows of spots and tail with light bands.

*Sphaerodactylus heliconiae* is notably distinct from other species of the genus by the extremely large size of its abdominally-confined escutcheon; and from other South American species by its median subcaudal series of enlarged scales. In addition, *S. heliconiae* differs

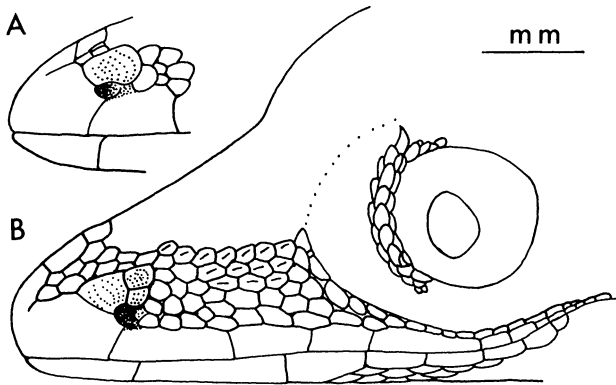


Figure 1. The snout squamation of *Sphaerodactylus lineolatus* (A, UIMNH 46793) and *S. heliconiae* (B, UMMZ 171651).

from *S. lineolatus* by having two supranasals, and by lacking the cross-bands seen in juvenile *S. lineolatus*. These characteristics also distinguish it from *S. scapularis*, along with presence of keeled rather than smooth dorsal scales. Both male and female coloration of *S. heliconiae* differs from that of *S. molei* though the general theme may be similar.

**DESCRIPTION.**—(four males, five females). A moderately large *Sphaerodactylus*; adult males measure 28.6–30.8 ( $\bar{x}$ =30.0,  $s$ =0.99), females 27.6–31.2 ( $\bar{x}$ =30.0,  $s$ =1.54) mm SVL. Snout-ear distance 24.0–26.4% of SVL ( $\bar{x}$ =24.8,  $s$ =0.73). Head width 54.8–63.6% of snout-ear distance ( $\bar{x}$ =58.8,  $s$ =2.41). Head depth 35.1–43.3% of snout-ear distance ( $\bar{x}$ =38.7,  $s$ =2.81). Snout very long, its length (tip-orbit) equals the distance from ear to slightly ahead of center of eye. Sides of snout converge at 38–41° ( $\bar{x}$ =40.0,  $s$ =0.82, mode=40); tip rounded. Original tail 99–116% of SVL ( $\bar{x}$ =112.1,  $s$ =8.00,  $N$ =6).

Rostral with short median cleft and large posterior indentation containing 1–3 small scales. Supranasals two, anterior one moderately large, as long as wide, dorsally confined, in narrow contact with nostril, separated from first supralabial by small posterior supranasal, 1–2 postnasals behind nostril, and by rostral anteriorly (Fig. 1b). Internasals occupy space as wide as supranasal and at least 2–3 scales across (two appear fused in ICN 3223). Snout scales flat, keeled, juxtaposed, 11–14 ( $\bar{x}$ =12.4,  $s$ =0.88) from orbits to rostral, four per IOW; scales narrow between eyes. Parietal surfaces and nape covered with smooth granules, ca. seven per IOW. Ocular spine short. Elongated fourth supralabial underlies anterior half of eye. Fourth infra-

labial lies below center of eye; first infralabial largest, its length equal to two IOW. Mental large, as long as wide, posterior border nearly straight. Postmentals polygonal, slightly elongated, 2–4 border mental. Gular scales smooth, granular, 6–7 per IOW.

Dorsal trunk scales oval, flat, keeled, juxtaposed, posteriorly raised, ca. five per IOW, 62–80 axilla-groin ( $\bar{x}=72.2$ ,  $s=4.92$ ). Lateral scales like dorsals or they may be swollen. Ventrals, 2.5 per IOW, 34–44 axilla-groin ( $\bar{x}=39.4$ ,  $s=3.88$ ). Ventral counts 48.7–60.3% of dorsal counts ( $\bar{x}=54.7$ ,  $s=4.66$ ). Scale rows around midbody 73–89 ( $\bar{x}=79.4$ ,  $s=5.22$ ). Escutcheon oval, large, occupying posterior third of venter, separated from vent by six scales; 12–17 scales long and 10–13 rows wide; comprised of 123, 151 (Fig. 3a), 154 and 94 total scales, respective to the order of the list of types above. Supracaudal scales rhomboid, flat, imbricate, keeled at tail base (for a head length), smooth distally; in diagonal and transverse series; three per IOW. Subcaudal scales smooth, larger than supracaudals; scales of median series distinctly larger and widened, 4–5 times width of a supracaudal scale (Fig. 3b–c). Males without swollen granules lateral to vent. Limb squamation similar to that of trunk except scales of prefemoral surfaces imbricate. Digit scales smooth, subimbricate, transversely expanded into lamellae below; 10–13 lie under fourth toe.

On males, dark brown and gray form bold reticulum on dorsum of trunk, limbs and tail, and bands on digits. Type specimen with pair of light centered suprascapular ocellae (Fig. 2d). Undersurfaces brownish gray except for head and hypertrophied escutcheon scales. Entire head reddish (rich orange, buffy orange below, in life) with one brown line on canthus and two on temple extending from eye. In MCZ 29699, head ornate with longitudinal light, dark-bordered bands or series of large spots above and below canthus, from upper posterior edge of eye backward to level of ear, from eye to ear, and from corner of mouth to below ear, and also with six frontoparietal spots and faintly marbled throat. Upper surfaces of females medium brown with dark lines on head, anterior trunk and base of tail (Fig. 2a–b). Canthal line and its continuation behind the eye most prominent. Single, parallel, dark lines occur above and below central line on temple. Temporal lines break up into series of dots on trunk then reform over pelvis and tail base where they may border a dorsolateral light stripe; a pair of small light-centered ocelli may occur over scapulae followed by additional pairs on trunk. Tail with six light, transverse bands with dark edges. Ventral surfaces uniform pale brown. In life, light areas pale yellow. Undersurface of tail was

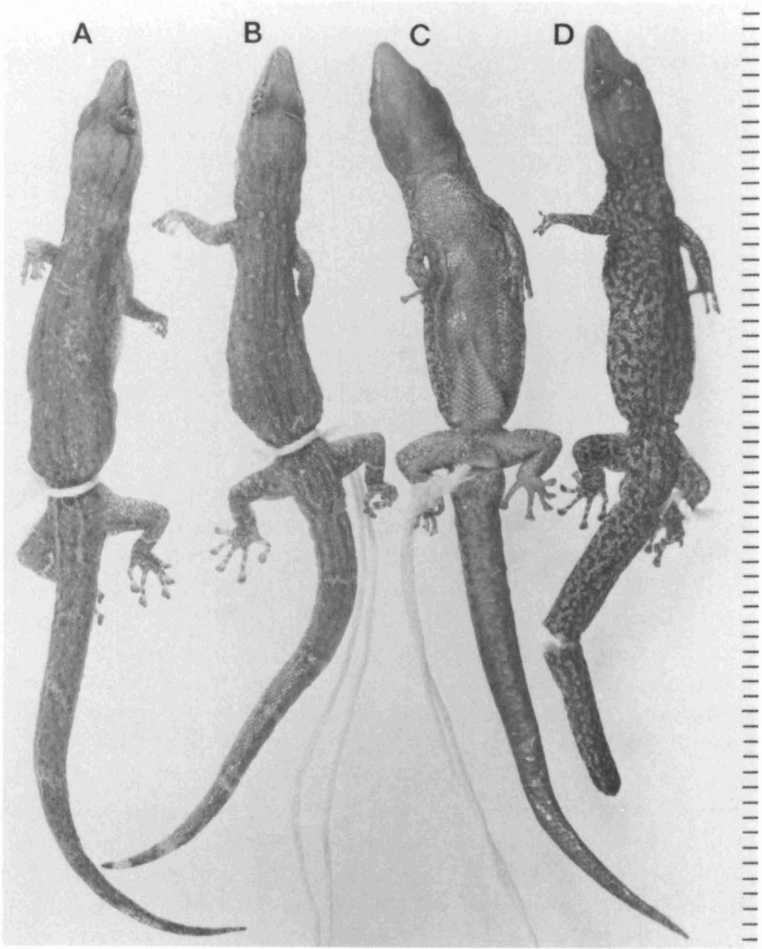


Figure 2. *Sphaerodactylus heliconiae* n. sp. Females: ICN 3223 (A) and UMMZ 171651 (B); Males: UMMZ 171652 (C) and ICN 3225 (D). The scale on the right side is in millimeters.

orange-yellow in ICN 3226. Juvenile coloration unknown, but expected to be similar to that of female.

**DISTRIBUTION.**—Lowlands of the lower Magdalena River Valley, Colombia (Fig. 5).

**REMARKS.**—The most unusual characteristic of *S. heliconiae* is the huge, abdominally-confined male escutcheon. Equally high escutcheon scale counts sometimes occur in specimens of *S. millepunctatus*

from Middle America, but these counts include subfemoral escutcheon scales in addition to the abdominal scales. At the onset of this project, Albert Schwartz noted (pers. comm.) that the escutcheon was so large in *S. heliconiae* that the species might possibly be related to the genus *Lepidoblepharis* where such large escutcheons are typical.

*Sphaerodactylus heliconiae* females produce one egg at a time, apparently alternating ovaries. Of the five females, two contained single, yolked, ovarian follicles measuring 2.5 and 2.6 mm in diameter. Two others had single oviducal eggs 4.1 and 4.4 mm in diameter. The fifth female contained a 1.2 mm white follicle in each ovary. These measurements were made on fresh specimens.

*Sphaerodactylus lineolatus* Lichtenstein and von Martens  
Figs. 1a and 5 (map)

*Sphaerodactylus lineolatus* Lichtenstein and von Martens (in Lichtenstein, 1856:6). Type locality: Veragoa. Syntypes: ZMB 417, ZMB 36297 b-c. Collector: [J. von Warszewicz (G. Peters, pers. comm.)].

*Sphaerodactylus casicolus* Cope, 1862:499. Type locality: Region of the Truandó, New Granada. Type: Mus. Washington, [USNM—presumed lost (W. R. Heyer, pers. comm.)]. Collector: not given.

DIAGNOSIS.—A moderately large *Sphaerodactylus*, males and females attaining 30 and 32 mm SVL, respectively. Dorsal trunk scales minute, homogeneous and moderately keeled; 62–81 between axilla and groin. Ventral count 33–42, averaging 52.9% of dorsal count. Scale around midbody 74–94. Parietal granules usually smooth. Single large supranasal, descending behind nostril; separated medially by one small scale (Fig. 1a). Rostral with long median cleft and small posterior notch filled by part of a small scale. Fourth supralabial lies below anterior half of eye; fourth infralabial below center of eye. Subcaudal scales up to three times width of supracaudals; not forming continuous median series, but with repeating sequence of a small, a large and a pair of small scales. Escutcheon small, contained on posterior fourth of venter, not extending onto thighs; composed of 20–51 scales. Dorsum in adults of both sexes variegated; head with longitudinal lines, accentuated in intensity in males. Juveniles with broad dark brown cross-bands (four on dorsum of trunk and nape) becoming indefinite with age (may be retained as transversing rhombs in adults). *Sphaerodactylus lineolatus* differs from *S. heliconiae* in its single supranasal, smaller escutcheon, lack of a median row of

subcaudals, and presence of dark cross-bands in the pattern; from *S. molei* in its single supranasal and general coloration; from *S. scapularis* in its having keeled rather than smooth dorsal scales and perhaps by pattern. The subcaudal configuration of scales is unique among continental sphaerodactyls.

VARIATION.—A series of 41 *S. lineolatus*, UIMNH 46791–46832 less 46829, from Ft. Clayton, Corozal, Panamá (Grant, 1959) was examined to determine within population variation. Males smaller than females (Table 4), measuring 24.6–29.6 ( $\bar{x}$ =28.0,  $s$ =1.29,  $N$ =18) mm SVL compared to 26.8–32.0 ( $\bar{x}$ =29.7,  $s$ =1.77,  $N$ =15). A recent hatchling, so judged by presence of an umbilical opening, 13.5 mm SVL. For adults, sexes combined, snout-ear distance 23.3–25.5% ( $\bar{x}$ =24.4,  $s$ =0.66) of SVL; head width 57.1–67.5% ( $\bar{x}$ =64.1,  $s$ =2.49) of snout-ear distance; head depth 41.7–49.3% ( $\bar{x}$ =45.6,  $s$ =1.66) of snout-ear distance. Sides of snout converge at 36.0–45.5° ( $\bar{x}$ =41.8,  $s$ =2.02, mode=41). Orbit-rostral count 8–10 ( $\bar{x}$ =9.1,  $s$ =0.70). Complete original tail 92.3–107.3% of SVL ( $\bar{x}$ =99.7,  $s$ =5.40,  $N$ =6). Fourth supralabial divided in eight of 41 specimens. Dorsal count 62–81 ( $\bar{x}$ =69.3,  $s$ =4.49); ventral count 33–42 ( $\bar{x}$ =36.6,  $s$ =2.25), 46.1–60.3% ( $\bar{x}$ =52.9,  $s$ =3.92) of dorsal counts; scale rows around midbody 75–94 ( $\bar{x}$ =85.8,  $s$ =4.46); toe IV infradigital lamellae 11–15 ( $\bar{x}$ =12.9,  $s$ =0.94). Escutcheon, 5–8 × 6 composed of 24–35 total scales ( $\bar{x}$ =30.0,  $s$ =2.67,  $N$ =19). Grant (1959, see Figs. 1 and 2) discussed pattern variation in adults. Juveniles have broad dark bands which cross over the nape, scapulae, midbody and pelvis, with an additional four on tail, separated by wider immaculate light areas; light neck band distinctly paler; head grayish with longitudinal darker lines; underparts light.

DISTRIBUTION.—South central Panamá into northwestern Colombia (Fig. 5).

REMARKS.—Living specimens from Tolviejo, Colombia exhibited the following coloration: ICN 3219, a 24 mm SVL male—head darkest; fawn brown; venter beige, underside of tail yellow, dorsum with numerous indistinct longitudinal streaks. ICN 3218, a 27.5 mm female, was similar in color to ICN 3219. ICN 3220, a 25 mm female, was greenish gray with dark brown cross-bands above. It had two light nuchal spots. The underside and terminal light band of tail were faint pink. ICN 3221, a 16 mm juvenile had a gray head above and below. The body had dark brown bands alternating with tan; occipital light band lighter than the other light areas. In their field notes, Owen Sexton and George Hunt described color in life for male specimens



from Panamá as “yellow gecko, tail yellow, head yellow” (UMMZ 124889, 29 mm SVL), “underside of tail yellow” (UMMZ 124890, 25 mm SVL), and “tail yellow on ventral side” (UMMZ 124892, 23.8 mm SVL). Arnold Kluge described Panamanian male specimens as “In life, yellow head and tail, throat particularly bright” (UMMZ 135351, 27.6 mm SVL), “brown above with darker brown stripes and spotting and reticulation on tail; tail (all sides) orange, venter of body pale yellow, throat flesh color with dark brown reticulations” (UMMZ 135368—AGK 3633, 27.9 mm SVL), and “Head lemon yellow with white stripes; tail bright orange” (UMMZ 135368—AGK 3646, 25.3 mm SVL). Another Panamanian specimen photographed by Stan Rand had a black and white striped head. Though female specimens are equally common in collections, I have found no additional color notes for them which may indicate that they are drab.

*Sphaerodactylus lineolatus*, as it has been generally regarded in the literature is, in fact, a composite of several species, including an undescribed species from the Pacific versant of the Costa Rican—Panamanian border area, *S. millepunctatus* of Costa Rica—México, *S. homolepis* from the Atlantic side of eastern Panamá and adjacent Nicaragua and *S. molei*. The literature pertaining to these species in Middle America is confused, and complete synonymies are being published elsewhere (Harris and Kluge, ms).

References to *S. lineolatus* in South America are usually found under *S. lineolatus* or *S. casicolus* and are without confusion, except in four instances. Günther (1885–1902:82) listed a specimen of “*S. lineolatus*” as “Guiana, Demerara (Quelch)” which must refer to BMNH 89.9.30.1, an adult male of *S. molei*, J. J. Quelch, leg. *Sphaerodactylus lineolatus* “Var. A.” in Boulenger (1885:221) is BMNH XXI.72b, an adult male *S. molei*. Boulenger (1899:914) referred to Pratt’s *S. lineolatus* specimen from Medellín as *S. homolepis* (see below). Peters (1967:34) listed *S. lineolatus* from Ecuador, based upon USNM 65451 from Macas. I have reidentified USNM 65451 as *S. millepunctatus* by its having keeled dorsal scales, a low dorsal scale count (61), two supranasals per side, a row of transversely expanded subcaudal scales, and bell-shaped escutcheon with subfemoral extensions. I am informed, too, that USNM 65451 was found in a fruit storage area in Starkville, Mississippi (Ron Crombie, pers. comm.), and therefore, the Macas locality must be discounted.

*Sphaerodactylus casicolus* Cope was recognized until 1921 when Barbour placed it in the synonymy of *S. lineolatus*. Cope’s specimen was “Dark brown rufous, with three distant, transverse, dorsal blotch-

es, bordered with lighter; the anterior or interscapular indistinct. A dark spot upon the nape, bounded by two light dots. Numerous short longitudinal white lines upon the dorsal and lateral regions; none upon the head. A loreal and three postocular dark lines. Beneath whitish, chin and sides of neck punctated with rufous." Cope apparently had an adult which had retained some evidence of the juvenile banding which is frequently seen (in four of nine Colombian specimens). The escutcheon of the Colombian males is larger than that of Corozal, Panamá examples, the three specimens having 37, 40 and 42 scales in the escutcheon, versus 23–33. Other populations within Panamá, however, have greater escutcheon counts. This plus differences in coloration and degree of body scale keeling are the only ones found between Panamanian and Colombian populations. They seem rather small and within an acceptable range for intraspecific variation. Therefore, *S. casicolus* is left in the synonymy of *S. lineolatus*.

One specimen, BMNH 97.11.12.1 collected from Medellín by A. E. Pratt, deserves special mention. Medellín proper, at 1500 m altitude, is not a likely locality for *S. lineolatus*, however there are tropical lowlands nearby which offer suitable habitat. The specimen is an adult sized female (28.8 mm SVL) whose squamation coincides well with *S. lineolatus*, but whose coloration is rather different. The coloration is similar to that of female *S. homolepis* of the Caribbean versant of western Panamá and southern Nicaragua, being largely unchanged from the juvenile cross-banded pattern common to that species and *S. lineolatus*. Usually, adult *S. lineolatus* show none or only patchy remains of the juvenile pattern, but in the Medellín specimen there is no apparent fading of the dark cross-bands. The dark bands (four precaudal) are about 10 dorsal scales wide, bordered by immaculate light bands three scales wide. Alternating between the lighter "border" bands are light zones with rufous stippling which are 18–24 scales wide. The anterior border of the nuchal band has two paramedian pairs of light spots. The venter is immaculate cream color. Two scale characteristics clearly set BMNH 97.11.12.1 apart from *S. homolepis*, the "lineolatus" subcaudal scale configuration (*S. homolepis* has a simple alternating pattern without enlarged elements), and the dorsal count of 76 scales axilla-groin (*S. homolepis* has 48–67, N=47). It may also be noted that the Medellín specimen has a rather acute snout (40°). Though the specimen is quite different from other *S. lineolatus*, additional material must be collected from the Medellín area in order to know whether the form is taxonomically distinct.

SPECIMENS EXAMINED.—COLOMBIA: Antioquia: Medellín

(BMNH 97.11.12.1); Villa Arteaga (FMNH 78132). Bolívar: Cartagena, 2 m (FMNH 165813). Chocó: Curiche (FMNH 170058); Parque Nacional Natural Los Katíos, surrounding Alto de Limón, 800 m (INDR 1283); Río Juradó, 200 m (ANSP 25190); Unguia, 25 m (FMNH 63818). Sucre: 9 km N Tolviejo, 100–200 m (ICN 3218–21).

PANAMA: Canal Zone: Ft. Clayton, Corozal (UIMNH 46791-46832). Veraguas: Veragoa [=Santiago] (ZMB 417 and 36297 b-c). Others listed in Harris and Kluge, ms.

*Sphaerodactylus molei* Boettger (in Mole and Ulrich)

*Sphaerodactylus molei* Boettger (in Mole and Ulrich, 1894:80). Type locality: Caparo, Trinidad. Syntypes: Two [Senckenberg Museum (Barbour, 1921)]. Collector: R. R. Mole.

*Sphaerodactylus buergeri* Werner, 1900:264. Type locality: Port-of-Spain, Trinidad. Holotype: ZFMK 20712 [formerly at Göttingen (Herpetol. Rev. 11:98)]. Collector: Otto Bürger.

*Sphaerodactylus venezuelanus* Roux, 1927:254. Type locality: "El Mene" de Acosta (Dr. Hans G. Kugler, pers. comm.) Falcón Province, Venezuela. Lectotype: NMB 9339. Collectors: H. G. Kugler and L. Vonderschmitt.

*Sphaerodactylus boettgeri* (nomen nudum) Donoso-Barros, 1968:110.

DIAGNOSIS.—A medium sized sphaerodactyl, not known to exceed 29 mm SVL. Dorsal trunk scales strongly keeled, minute, homogeneous, 63–83 groin-axilla. Ventrals 31–39. Scales around midbody 65–81. Ventral count averages 47.5% of the dorsal count. Parietal granules keeled. Supranasals two; larger anterior ones separated by 1–3 small internasals. Rostral deeply notched behind, filled by 1–3 small scales; median cleft short. Fourth supralabial lies below anterior half of eye; fourth infralabial below center of eye. Subcaudal scales to three times width of supracaudals, alternately arranged. Escutcheon confined to posterior fourth of venter, composed of 20–45 scales. Dorsal surfaces light brown with a light dorsolateral stripe, variously faded or accentuated on trunk, but never indefinite (i.e., broken).

*Sphaerodactylus molei* differs from both *S. lineolatus* and *S. scapularis* in snout squamation; degree of body scale keeling and coloration; and from *S. heliconiae* in escutcheon size, subcaudal squamation and coloration.

DESCRIPTION.—From the examination of 37 Trinidad specimens, adult males and females measure 20.6–28.0 mm SVL ( $\bar{x}$  = 23.94,  $s$  = 1.727,  $N$  = 16) and 20.8–27.7 mm SVL ( $\bar{x}$  = 25.11,  $s$  = 2.257,  $N$  = 16); smallest specimen 16.6 mm (AMNH 15619 of unknown lo-

cality is 14.3 mm). Snout-ear length 23–27.2% of SVL ( $\bar{x}$ =25.2,  $s$ =1.38,  $N$ =14). Head width 53–64.9% of snout-ear distance ( $\bar{x}$ =58.5,  $s$ =3.51,  $N$ =14). Head depth 33.3–44.3% of snout-ear distance ( $\bar{x}$ =39.9,  $s$ =3.24,  $N$ =14). Snout long, length equal to distance from ear between posterior fourth and center of eye. Sides of snout converge at 39–46° ( $\bar{x}$ =42.3,  $s$ =2.34,  $N$ =26, mode=40); tip rounded. Original tail 97–115% of SVL ( $\bar{x}$ =103.3,  $s$ =5.49,  $N$ =8). Rostral with short median cleft and large posterior indentation filled with 1–3 small scales. Two supranasals (fused on one side in a single specimen); anterior larger, round, dorsally confined, in narrow contact with nostril, separated from first supralabial by small posterior supranasal and 1–2 postnasals behind nostril and by rostral anteriorly. Space between supranasal scales as wide as anterior supranasal; 2–3 small scales separate supranasals. Snout scales flat, keeled, 9–12 ( $\bar{x}$ =10.1,  $s$ =1.04,  $N$ =36) from orbits to rostral, four per IOW. Scales narrow between eyes. Parietal surfaces and nape covered with keeled granules, 6–7 per IOW. Fourth supralabial elongated, underlying anterior half of eye. Fourth infralabial below center of eye; first infralabial largest, its length 1.3–1.5 times IOW. Mental large, as long as wide; its borders with first infralabials slant backward from mouth. Postmentals polygonal, rounded; 2–4 border mental. Gular scales smooth, granular, 5–7 per IOW.

Dorsal scales of trunk rhomboid, strongly keeled, juxtaposed, somewhat raised, with free posterior edges, ca. five per IOW, 63–83 ( $\bar{x}$ =72.6,  $s$ =4.80,  $N$ =37) axilla-groin. Lateral scales like dorsals or swollen. Ventrals 2.0–2.5 per IOW, 31–39 ( $\bar{x}$ =34.4,  $s$ =1.95,  $N$ =37). Ventral counts 41.9–54.0% of dorsal counts ( $\bar{x}$ =47.5,  $s$ =3.32,  $N$ =37). Scale rows around midbody 65–81 ( $\bar{x}$ =72.7,  $s$ =3.77,  $N$ =37). Escutcheon (Fig. 3d) small circular, confined to posterior fourth of venter, composed of 23–45 ( $\bar{x}$ =31.6,  $s$ =6.12,  $N$ =16) scales (6–7 scales long and 6–8 rows across). Supracaudal scales rhomboid, flat, imbricate, three per IOW, keeled at tail base for a head length, smooth distally; arranged alternately (Fig. 3f). Subcaudal scales as much as three times width of supracaudal scales; similar in form to ventrals, neither aligned in a longitudinal median row nor widened (Fig. 3e). Swollen granules lateral to vent not evident in males. Limb squamation similar to that of trunk, imbricate on prefemoral surfaces. Digit scales smooth, subimbricate, transversely expanded into lamellae below, 10–12 ( $\bar{x}$ =10.7,  $s$ =0.58,  $N$ =37) under fourth toe.

Coloration of male in ethanol (UMMZ 155796, Fig. 4b). Dorsum of trunk and limbs pale tan; tail variegated with light brown; top of

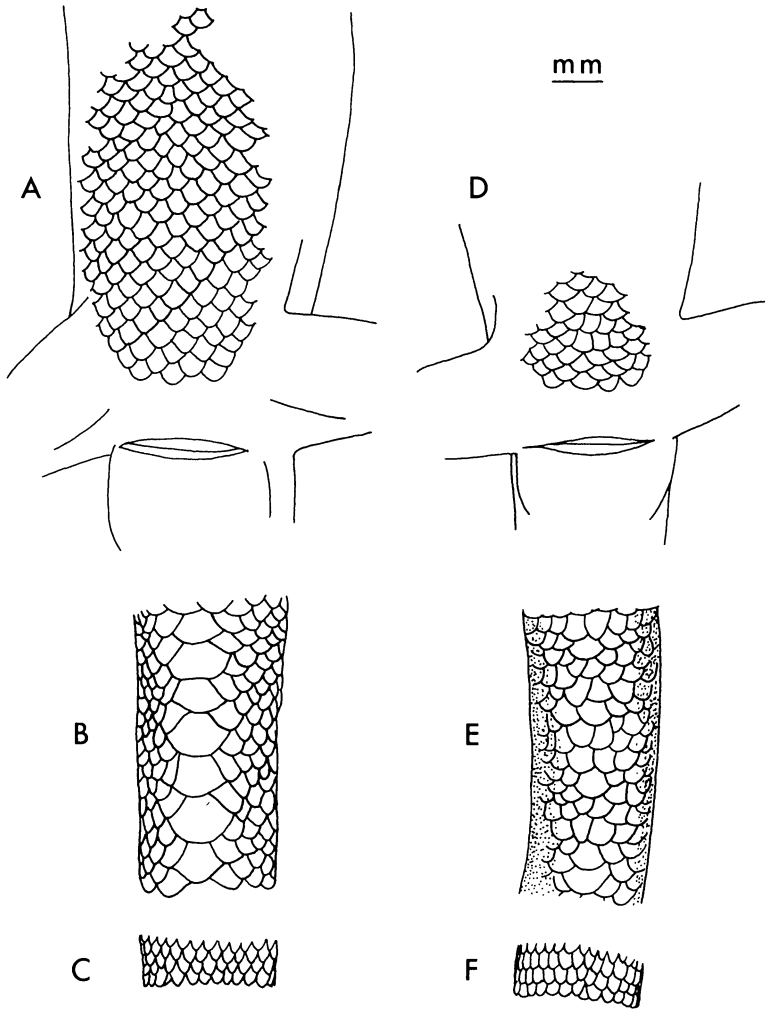


Figure 3. The escutcheons (A,D), subcaudal scales (B,E), and supracaudal scales (C,F) of *Sphaerodactylus heliconiae* and *S. molei*, respectively. The diagrams were drawn from MCZ 29699 (A), ICN 3225 (B,C), FMNH 49814 (D), and UMMZ 155796 (E,F).

head, to nape, dark brown with brilliant white, longitudinal bands on temples and on top of head. The latter converge at nape and are less pronounced; canthus with a dark brown line. Undersurfaces light cream. Digits faintly banded. Smaller males show less dark brown and white on head, and more vivid dorsolateral stripes. Females pale tan;

lighter below; with pair of yellowish, dark bordered, dorsolateral stripes beginning at eye and fading on tail (sometimes faded on body); canthus with a dark line; tail may be indistinctly cross-banded with light color; also chin may show dark speckling (see also Barbour, 1921:Plate 1, Fig. 4). Young individuals colored like females, but with more vivid dorsolateral stripes.

Color in life of a Maracas, Trinidad male (from two transparencies taken by Dr. Julian S. Kenny of the University of the West Indies; now UMMZ slide series). Top of head black with brilliant white longitudinal stripes, irregularly washed with yellow. Eye gray-brown with dark band crossing center, continuous with dark skin color before and behind eye. Lower sides of head and neck, and probably gular areas, tawny yellow. Dorsal surface of body and limbs purplish pink, as if skin was devoid of pigment, with small slightly darker spots posteriorly. Underparts cream. Fingers banded. Tail gray-green, with moderately large, irregular, raw sienna spots.

DISTRIBUTION.—Trinidad and Tobago, and coastal region of Venezuela and Guyana (Fig. 5).

REMARKS.—Females have essentially the same color-pattern throughout the range of the species; however, males exhibit three coloration types. One, of Trinidad, is characterized by the strong head coloring ending abruptly on the nape (Fig. 4b). Males from Guyana are similar, but the head stripes end in points (see Beebe, 1944:Plate IV, Fig. 10). The third type is found in specimens from Estado Falcón, Venezuela, and also Tobago Island. In these the dorsum may become highly melanized, essentially forming dark stripes which edge the lighter dorsolateral stripes. The dark stripes break up into spots posteriorly. Also, the specimens do not show pure white head stripes as do Trinidad and Guyanan examples. The lectotype of *S. venezuelanus* (Fig. 4a) shows an extreme example of this pattern. Noteworthy of this specimen is the inclusion of rather large spots within the light dorsolateral stripes. This is not unique to NMB 9339; MCZ 48899 also shows some minute dark spots within the light dorsolateral stripes. Three males from Tobago were illustrated by King (1962:Fig. 13 a, b and e). Though comparable in size, the three show an extreme degree of variation from the dark striped-spotted phase to a pattern without dark coloring similar to a female. Variation is evident, but the largest males from Tobago and Estado Falcón, Venezuela consistently have the dark dorsal coloring.

The taxon *Sphaerodactylus venezuelanus* was originally described from two specimens, a male NMB 9339 and a female NMB 9340. I

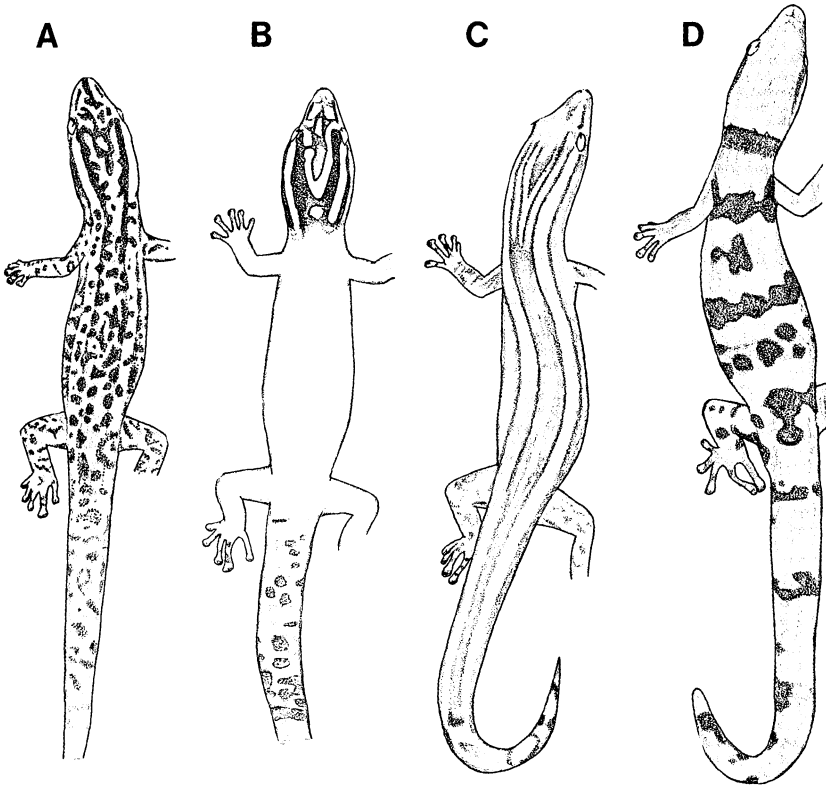


Figure 4. Color patterns of male *Sphaerodactylus molei* from Estado Falcón, Venezuela (A, lectotype of *S. venezuelanus*) and Trinidad (B, UMMZ 155796); female *S. molei* (C, holotype of *S. buergeri*); and female *S. scapularis* (D, BMNH 1902.7.29.1).

have examined the former and designate it the lectotype of *S. venezuelanus* Roux. The striking coloration, and presence of an escutcheon make this specimen the more desirable choice for lectotype. NMB 9339 was previously called "lectotype" in a non-review (Kramer, 1979) and "type" in Mechler's review (1968).

The *S. venezuelanus* lectotype differs very little in squamation from *S. molei* of Trinidad. The dorsal (67) and ventral (32) counts are entirely consistent, though the scale rows around the midbody (85) exceed the *S. molei* sample extreme by four. The escutcheon is four scales long and seven wide, and comprised of 20 hypertrophied scales in a small circular post-abdominally confined patch. The SVL of

NMB 9339 is 23.0 mm. All other counts and measures lie within the ranges of variation seen in Trinidad *S. molei*. Additionally, NMB 9339 has two supranasals per side, internasals which intrude the deep rostral notch, alternating subcaudal scales, and keeled dorsal scales. The granules covering the parietal surfaces and nape do not appear keeled and the body scale keeling is not as marked as in Trinidad examples of *S. molei*. None of these features suggests to me the need to remove *S. venezuelanus* from the synonymy of *S. molei*, as first suggested by Shreve (1947).

Other specimens from Falcón also vary little in squamation from those of Trinidad. Dorsal and ventral counts of Falcón specimens (MCZ) are generally lower, 57–67 ( $\bar{x}$ =63.0,  $s$ =4.04,  $N$ =7) and 29–32 ( $\bar{x}$ =31.9,  $s$ =2.12,  $N$ =7), respectively, the mean dorsal counts being significantly different from the Trinidad sample ( $P < 0.001$ , Student's  $t$ ). Ventrals number 42–60% ( $\bar{x}$ =50.8,  $s$ =0.06) of dorsals, similar to Trinidad *S. molei*. All other scale counts, escutcheon shape and size, snout and subcaudal squamation of the Falcón and Trinidad populations are similar adding further evidence for their conspecificity.

Shreve (1947) presented a possible scenario for explaining the variability in coloration of a series of *S. molei* from Falcón, Venezuela, basically saying that it could be caused by intergradation between a striped form and a Trinidad color form of *S. molei*. Pure populations of his striped form would hypothetically inhabit the Santa Marta region of Colombia where *S. heliconiae* has been found. First, it seems that Shreve's hypothesis is more complicated than necessary. If size (inferring age) and sex are considered (which Shreve did not), it may be seen that there is more dark coloration in larger males, implying that it is developed with age. Females undergo no or little color development. As such, Falcón populations are not necessarily variable because of intergradation, but simply as a result of sex and age differences.

The holotype (by monotypy) of *Sphaerodactylus buergeri* Werner from Port-of-Spain, Trinidad (ZFMK 20712) is a 26.7 mm SVL female. Its dorsal (74), ventral (36), and midbody (77) scale counts, and all other characteristics, are within the range of variation of *S. molei* from Trinidad. The specimen is rather strongly patterned (Fig. 4c) which may explain why Werner (1900) emphasized the dark-color aspects of the pattern rather than the light.

The occurrence of *S. molei* in Colombia has not been confirmed, though several authors, following Dunn (1944), have cited it from



there (Vanzolini, 1968; Peters and Donoso-Barros, 1970; Schwartz, 1973). It seems possible that the arid Guajira Peninsula, meeting the northern extension of the Eastern Cordillera of the Colombian Andes which coincides with the international boundary, may constitute a distributional barrier to *S. molei*. It must also be mentioned that collecting efforts in northern South America have been extremely limited, so any conjectures on distributional limits, especially of rare species, are likely to be disproven.

Beebe (1944:154) described the color in life for males, females and juveniles from Guyana. Shreve (1947:523) reported color information from Kugler's field notes of specimens from Pauji, Acosta District, Falcón, Venezuela. In both accounts, orange and yellow are often mentioned, especially in reference to the tail and throat. Additional references to *S. molei* include a note on escutcheon form (Noble and Klingel, 1932:14), the review of Barbour (1921) who first suggested the synonymy of *S. buergeri* with *S. molei* (p. 249), and Roux's (1926) report on four Trinidad specimens.

SPECIMENS EXAMINED.—GUYANA: Bartica District (AMNH 36249); Demerara [=Georgetown] (BMNH 89.9.30.1); Kartabo [Kartabu point, jct. Cuyunie and Mazaruni Rivers, 8 m] (AMNH 15136, 18192, 21255-57, 21297-98, 32284; UMMZ 65168); Santa Rosa, Amakura River [site not located] (UMMZ 83743); Santa Rosa Is., Moruka River (MCZ 14676; UMMZ 56030); Winiperu (BMNH 1968.1264-65).

TRINIDAD AND TOBAGO: TOBAGO: Scarborough, burial ground (MCZ 55714-17); Scarborough, Ft. George, 100 m (MVZ 84033). TRINIDAD: No data (BMNH 1940.2.2.1-2). Caroni Co.: Warrenville (MCZ 125492). Nariva Co.: Brickfield (FMNH 49813-16). St. Andrew Co.: Guaico (MCZ 12054-55); Manzanilla Bay (USNM 141584-86). St. David Co.: Toco (AMNH 94880). St. George Co.: Arima Valley (MCZ 160064); Imperial College of Tropical Agriculture [near Tunapuna] (AMNH 72891); Port-of-Spain (MCZ 159775; ZMFK 20712); San Rafael (FMNH 49818-20); Simla, 4 mi. N Arima, 800 ft. alt. (AMNH 94412; UMMZ 125793, 155796-97); Simla, Blanchisseuse Valley (MCZ 160070-71); Tucker Valley (AMNH 101322-24); Waterfalls Rd., Maracas, St. Joseph (UMMZ slide series). Victoria Co.: Canari Bay, 6 mi. E Moruga (MCZ 160089-90); San Fernando (BMNH 1964.1472); San Fernando, Palmiste Estate (MCZ 100457-58, 159989-96).

VENEZUELA: Carabobo: Urama, 100 m. elevation (MVZ 110733). Falcón: El Mene de Acosta (NMB 9339); Pauji, Acosta Dis-

trict (MCZ 48720–21, 48895–99); Km 40, 19 km NW Urama, 25 m, 10°37'N, 68°24'W (USNM 216891).

NO DATA: AMNH 15615–21; BMNH XXI.72b.

ADDITIONAL LOCALITIES.—TRINIDAD: Caroni Co.: Caparo (Mole and Urich, 1894).

VENEZUELA: Miranda: 34.4 km N Altigracia de Orituco, 900 ft. alt. (J. R. Dixon No. 25396). Sucre: "Cumaná (R. D-B., 1964) and Mariguitar (Garrido, 1963)" in Donoso-Barros (1968).

### *Sphaerodactylus scapularis* Boulenger

*Sphaerodactylus scapularis* Boulenger, 1902:54. Type locality: St. Javier, Ecuador. Holotype: BMNH 1946.8.30.70. Collector: W. F. H. Rosenberg.

DIAGNOSIS.—A moderately large *Sphaerodactylus* presently known from four female specimens, the largest of which measures 33.1 mm SVL (a very soft specimen possibly larger than in life). Dorsal trunk scales minute, homogeneous, smooth and slightly convex, 70–81 axilla-groin. Ventral count 33–38, averaging 46.3% of dorsal count. Scales around midbody 77–84. One supranasal above each nostril, medially separated by a single small scale. Rostral with long median cleft, with or without a small notch behind. Fourth supralabial lies below anterior half of eye; fourth infralabial below center of eye. Subcaudal scales up to three times width of supracaudals, alternating, not forming a median series, relatively uniform in size, and without repeating pattern described for *S. lineolatus*. Escutcheon unknown. Dorsum (females) with six irregular or broken bands from nape to pelvis.

This species differs from all other South American sphaerodactyls by lacking any evidence of body scale keeling. In addition, *S. scapularis* is distinguished from *S. lineolatus* by the subcaudal squamation and by having six (rather than four) dorsal bands or spots on the body. *Sphaerodactylus molei* and *S. heliconiae* are readily distinguished from *S. scapularis* by totally lacking dark bands and by having two supranasals per side.

DESCRIPTION.—(Based upon BMNH 1946.8.30.70, BMNH 1902.7.29.1–2, and BMNH 1926.1.20.105, respectively). Snout-vent length 28.6, 27.2, 33.1, and 23.8 mm. Snout moderately long, its length (orbit to tip) equal to distance from ear opening to, at most, center of eye. Sides of snout converge at ca. 43° in the three larger specimens. Complete original tail of BMNH 1902.7.29.1 is 107% of SVL.

Rostral with long median cleft, slightly notched or not behind. Supranasals large, entire, in broad contact with nostril; separated from first supralabial by single postnasal, and from each other by one small scale. Snout scales flat, smooth, juxtaposed, nine from level of orbits to rostral, four per IOW. Parietal surfaces and nape covered with smooth granules, ca. seven per IOW. Fourth supralabial elongated, lying below anterior half of eye. Fourth infralabial lies below center of eye; first infralabial largest, its length equal to 1.5 IOW. Mental large, as long as wide; its posterolateral borders slant forward. Postmentals polygonal, rounded, smooth, slightly swollen; two border mental. Gular scales smooth, granular, ca. seven per IOW, imbricating at ear level.

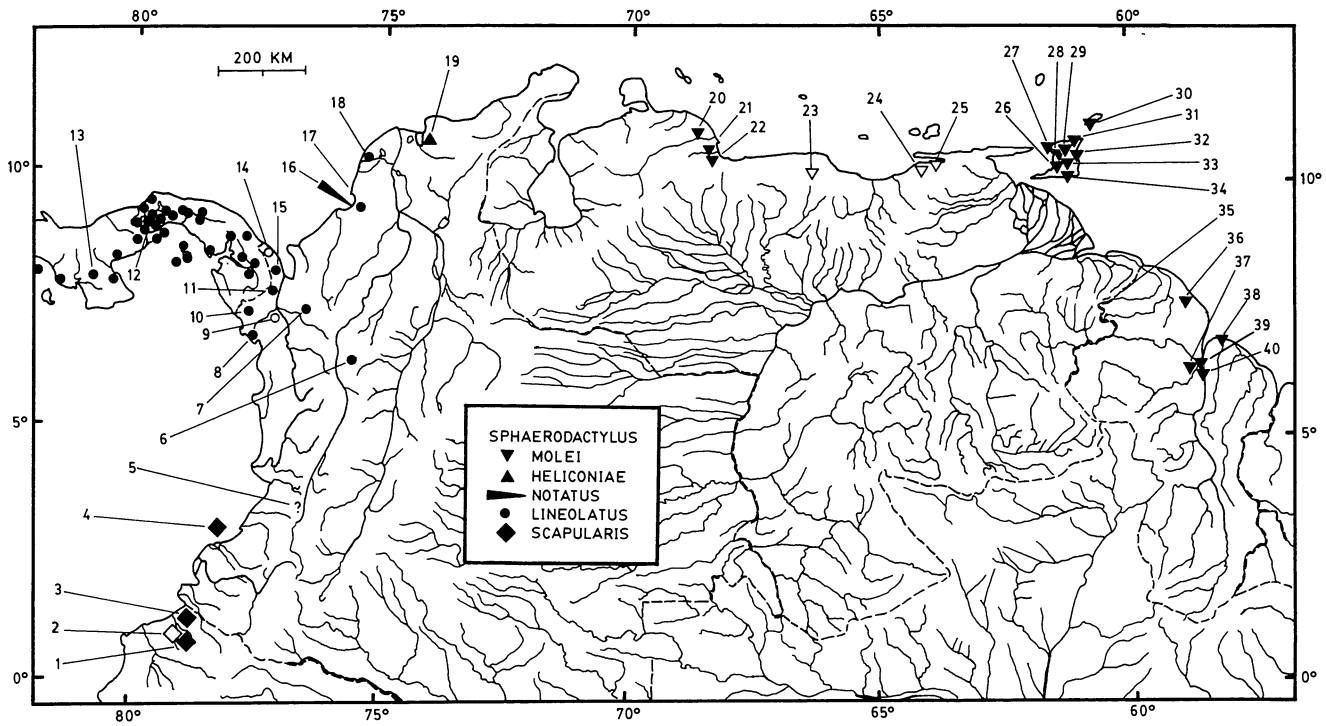
Dorsal trunk scales rhomboid, rounded, may be swollen, absolutely smooth, juxtaposed, with free posterior edges, ca. six per IOW; "?," 70, 76, and 81 axilla-groin. Ventral scales rounded, thin, smooth, imbricate, ca. three per IOW; 36, 34, 33, and 38 axilla-groin. Ventral counts "?," 48.6, 43.4, and 46.9% of dorsal counts. Scale rows around midbody "?," 82, 84, and 77. None of the available specimens bears an escutcheon. Supracaudal scales rhomboid, flat, imbricate, smooth, ca. three per IOW. Subcaudal scales slightly larger than supracaudals; those of median area just less than three times width of a supracaudal; arranged alternately. Limb squamation similar to that of trunk; scales of prefemoral surfaces imbricate. Scales of digits smooth, subimbricate, transversely expanded below into lamellae, 11–14 under fourth toe.

Color is drab purplish to yellowish brown in preservative. All specimens have dark cross-bands with uneven or irregular edges, often reduced to the form of a mid-dorsal rhomboid spot. There are six of these on the neck and body (Fig. 4d). The type specimen shows the greatest amount of reduction in this pattern, lacking some of the bands in the midbody area.

DISTRIBUTION.—Lowland Pacific versant of northern Ecuador and southern Colombia, the latter inferred from its occurrence on Isla Gorgona (Fig. 5).

REMARKS.—I was unable to positively distinguish this species from *S. lineolatus* by examining the type specimen whose tail was lacking and whose scales have lost all structural integrity. The best specimen, from a diagnostic sense, is BMNH 1902.7.29.1 (Fig. 4d) which presents all of the diagnostic characteristics for a female of the species. From an operational perspective, it is the type, of *S. scapularis*.

The Gorgona Island specimen has swollen, granular dorsal scales rather than flat ones. The lateral scales of *S. lineolatus*, *S. molei* and *S.*



*heliconiae* are often similarly swollen, or they may be flat. Therefore, I do not believe that the swollen dorsals are taxonomically significant.

An unlabeled specimen at the Universidad del Valle, Cali, Colombia (now ICN 3222) is perhaps a subadult (SVL=22 mm) male of *S. scapularis*. Its pattern and escutcheon form compare well with male *S. lineolatus*, however, its mostly smooth dorsals and simple, alternating median subcaudals appear more like the conditions in *S. scapularis*. Some of the dorsal scales are swollen and knobby to the extent that they appear to have a dull keel. The true identity of this specimen is questionable.

Several references to *S. scapularis* have appeared in the literature. Barbour (1921:218) doubted its generic assignment, but Parker (1926a) did not. Parker (1926b) first reported it from Isla Gorgona. Medem (1979) confirmed Parker's finding; however, his specimen is now lost (F. Medem, pers. comm.). Burt and Burt (1931) reported on two specimens from "near the Río Cayapas [=Río Cayapas], Ecuador. Their specimens, AMNH 8934-5, are missing as of February, 1982 (C. W. Myers, pers. comm.). Peters (1967), Vanzolini (1968), Peters and Donoso-Barros (1970) and Schwartz (1973) acknowledged the existence of the name, *Sphaerodactylus scapularis*. There is no apparent confusion in the use of the name in the literature.

SPECIMENS EXAMINED.—COLOMBIA: Cauca: Isla Gorgona (BMNH 1926.1.20.105).

ECUADOR: Esmeraldas: San Javier, 60 ft. alt. (BMNH 1946.8.30.70); Río Sapayo, 450 ft. alt. [=Río Zapallo, tributary of the Río Cayapas] (BMNH 1902.7.29.1-2).

NO DATA: ICN 3222 (cf.).

Figure 5. Distribution map of the *Sphaerodactylus* species in South America, including the known range of *S. lineolatus* in Panamá. Open symbols denote literature reports and the localities of specimens which I did not examine. Places mentioned in the text are indicated on the map as follows: 1. Río Zapallo; 2. Río Cayapas (Burt and Burt, 1931); 3. San Javier; 4. Isla Gorgona; 5. Cali; 6. Medellín; 7. Villa Arteaga; 8. Curiche; 9. "Region of the Truandó" (Cope, 1862); 10. Río Juradó; 11. Parque Katíos; 12. Ft. Clayton; 13. Veragoa; 14. Acandí (Medem, 1968); 15. Unguia; 16. Tolú; 17. Tolviejo; 18. Cartagena; 19. Candelaria and Sevilla; 20. El Mene de Acosta and Pauji; 21. 19 km NW Urama; 22. Urama; 23. 34 km N Altagracia de Orituco; 24. Cumaná (Donoso-Barros, 1968); 25. Mariguitar (Donoso-Barros, 1968); 26. San Fernando; 27. Tucker Valley; 28. Maracas, Port-of-Spain, Tunapuna, and Warrentville; 29. Arima, Caparo (Mole and Urich, 1894), San Rafael, and Simla; 30. Scarborough; 31. Toco; 32. Guaico and Manzanilla Bay; 33. Brickfield; 34. Canari Bay; 35. Amacura River; 36. Santa Rosa Island (Moruka R.); 37. Kartabo; 38. Demerara; 39. Bartica; 40. Winiperu.

*Sphaerodactylus notatus* Baird, 1858

This is the first report of *S. notatus* from South America, and I consider it an introduction. A single female specimen, FMNH 165811, was collected on the patio of the Playamar Hotel in Tolú, Department of Sucre, Colombia by H. Le Nestour, on 23 January 1965.

DIAGNOSIS.—(including FMNH 165811 in parentheses). Dorsal scales large, homogeneous, keeled, 18–36 (26) axilla-groin. Ventrals 25–33 (29). Midbody scales 35–55 (47). Two large supranasal scales present per side. Third supralabial lies below anterior half of eye. Subcaudal scales four times width of supracaudals, forming median row. Hypertrophied ventral scales extend onto thighs. FMNH 165811 has a brownish gray dorsum with moderate sized, evenly distributed, darker brown spots; head lighter, except for a median and two pairs of spotted longitudinal bands; nape with a dark brown spot flanked on each side by a small white spot; gular surface covered with small brown spots, otherwise, ventral surfaces light.

DISTRIBUTION.—Previously known from the Bahama Islands, southern Florida, Cuba, Isla de Pinos and Little Swan Island; introduced to Great Inagua and Morant Cays (Schwartz, 1966; 1973), and now also to Colombia.

REMARKS.—Confirmation that a population of *S. notatus* occurs in Tolú is needed. The Tolú specimen is most similar to specimens from Florida.

## DISCUSSION

LITERATURE RECORDS.—Several additional species are reported from "South America" and Caracas, Venezuela in the British Museum Catalogues of Gray (1845:168–9) and Boulenger (1885), respectively; however, the true origin in each case is uncertain. Though Boulenger considered the same specimens as did Gray (those with Roman Numeral Prefix), he was more precise and omitted the geographic origins rather than repeat "South America." Among those listed by Gray for South America, presented by Edward Laforest (before 1840) was one referred to as "*Sphaerodactylus copii*" by Boulenger (1885:225). The specimen was loaned to me under the name *S. fantasticus* (BMNH XXI.72a) and is of that taxon. Edward Laforest also presented the specimen BMNH XXI.72b, a 25.6 mm

SVL male of *S. molei*, which Boulenger (1885:221) referred to *S. lineolatus* "Var. A". The dark head coloring on the specimen ends abruptly on the nape which indicates that it may have come from Trinidad where that coloration type occurs. The *Sphaerodactylus sputator* of Boulenger (1885:220), purchased from Mr. Leadbeater, are more accurately referred to *S. torrei* (BMNH XXI.70a-e) of Cuba. Boulenger (1885) listed two specimens as having originated from Caraccas [sic.]: BMNH 53.2.4.61 which he called *S. fantasticus* and BMNH 53.2.4.67 which he called *S. punctatissimus*. Both specimens were purchased from Mr. Braconnig. I concur with the identification of the former, which is quite similar to Thomas' drawing of the subspecies *S. f. tartaropylorus* (Thomas, 1964:Fig. 6). The abdominal scales were reported to be smooth, which I can confirm, but also the gular and chest scales each bear a weak keel. The latter specimen from "Caraccas" is a 34 mm SVL female *S. cinereus*. The species listed in this paragraph, except *S. molei*, are not otherwise known to occur in South America. These specimens probably found their ways into the South American collection during Caribbean ship stops in Trinidad, Guadalupe (*S. fantasticus*), Cuba (*S. torrei* and *S. cinereus*), or elsewhere. I, therefore, do not regard any of them as having been collected on the South American continent.

INTERSPECIFIC SIMILARITY.—The native mainland South American sphaerodactyls are all rather similar to one another, showing relatively high dorsal and midbody scale counts, four supralabials to below the eye, and perhaps, also an abdominally-confined escutcheon. These characteristics differ from *S. notatus* which has very low dorsal and midbody counts, three supralabials to below the eye and subfemoral escutcheon scales (Table 1).

The high dorsal and midbody scale counts of the South American sphaerodactyls each show a broad range (20 scales) and a weak modal tendency (Tables 2 and 3). Also, the tables show that the dispersion of the counts is practically as great in a local population (e.g., *S. lineolatus*) as it is over a sizeable region (e.g., *S. molei*). King (1962) said that there is an ill-defined mid-dorsal zone of granules in *S. molei*. Such a zone is noticeable in two *S. heliconiae*, which incidentally, are the two having the highest midbody scale counts (Table 3); the other *S. heliconiae* lack the granular zone. Such variability is also seen in *S. molei* and *S. lineolatus*, and so, the character would appear to have little diagnostic value among the South American species.

Based upon color pattern and the arrangement of the supranasal scales, a major dichotomy appears among the South American

TABLE 1

DIAGNOSTIC CHARACTERISTICS OF SOUTH AMERICAN *SPHAERODACTYLUS* SPECIES. SCALE COUNTS FOR *S. LINEOLATUS* INCLUDE PANAMANIAN SPECIMENS (UNPUBLISHED DATA FROM HARRIS AND KLUGE, MS) DORSAL AND MIDBODY SCALE COUNT RANGES FOR *S. NOTATUS* ARE FROM SCHWARTZ (1966).

	<i>scapularis</i>	<i>lineolatus</i>	<i>heliconiae</i>	<i>molei</i>	<i>notatus</i>
Sample size	4	100+	9	37	—
Dorsal count	70–81	62–81	62–80	63–83	18–36
Midbody count	77–84	74–94	73–89	65–81	35–55
Supralabials	4	4	4	4	3
Escutcheon location	?	abdomen	abdomen	abdomen	abdomen + thighs
Posterior supranasal	absent	absent	small	small	large
Basic dorsal pattern of female/juvenile	6 dark cross-bands on head and body	4 dark cross-bands on head and body	dorsolateral, light spots in linear series	continuous, light, dorso-lateral stripes	small dark spots
Dorsal scale texture	smooth	keeled	keeled	keeled	keeled
Parietal granule texture	smooth	smooth	smooth	keeled	keeled
Total escutcheon scales	?	20–52	94–154	13–38	—
Configuration of subcaudal scales	alternating	repeating sequence: small-large-pair of small	median series	alternating	median series



**TABLE 2**

DORSAL SCALE COUNT FREQUENCIES OF *SPHAERODACTYLUS SCAPULARIS*; *S. LINEOLATUS* FROM COROZAL, PANAMÁ (○) AND COLOMBIA (●); *S. HELICONIAE*; and *S. MOLEI* FROM TRINIDAD. ONE MARK EQUALS ONE SPECIMEN. THE MEAN IS INDICATED BY  $\bar{x}$ . THE MEAN FOR *S. LINEOLATUS* PERTAINS TO THE COROZAL SAMPLE ONLY.

N	<i>scapularis</i>	<i>lineolatus</i>	<i>heliconiae</i>	<i>molei</i>
83				○
82				○
81	○	○		
80		○	○	
79				○
78				○○○
77				○○
76	○	●	○	○○
75	$\bar{x}$ -	○○○○		○○○
74		●	○	○○○
73		○○○	○○	○○○○○
72		○○●●	$\bar{x}$ -	○
71		○○		
70	○	○○○○●	○○	○○○○○○○
69		$\bar{x}$ -		○○
68		○○○○○●●		
67		○○○○○		○○
66		○○○○●		
65		○○●		○○
64		○		○
63		○○○		○
62		○	○	

sphaerodactyls. The western species, *S. lineolatus* and *S. scapularis*, share shorter, blunter snouts, dark cross-bands on juveniles, and single supranasal scales. The more eastern *S. heliconiae* and *S. molei* share longer, sharper snouts, longitudinal lines or series of spots in the pattern, and divided supranasal scales.

*Sphaerodactylus heliconiae* and *S. molei* have head shapes which resemble one another. Their heads are longer relative to SVL, and narrower and flatter relative to the snout-ear distance than the head of *S. lineolatus*. The relationship of *S. scapularis* is possibly consistent with *S. lineolatus*, however, the available specimens of the former are too poorly preserved to give reliable measurements.

From casual examination, the snout of *S. heliconiae* appeared to

TABLE 3

MIDBODY SCALE COUNT FREQUENCIES OF *SPHAERODACTYLUS SCAPULARIS*; *S. LINEOLATUS* FROM COROZAL, PANAMÁ (○) AND COLOMBIA (●); *S. HELICONIAE*; and *S. MOLEI* FROM TRINIDAD. ONE MARK EQUALS ONE SPECIMEN. THE MEAN IS INDICATED BY  $\bar{x}$ . THE MEAN FOR *S. LINEOLATUS* PERTAINS TO THE COROZAL SAMPLE ONLY.

N	<i>scapularis</i>	<i>lineolatus</i>	<i>heliconiae</i>	<i>molei</i>
94		○○○		
93		○		
92		○○○		
91		●		
90		○●		
89		○●●●	○	
88		○○○		
87		○○○○○	○	
86		$\bar{x}$ ○○○○○●		
85		○○○○		
84	○	○○○		
83		○○		
82	$\bar{x}$ ○			
81		○○○●		○
80		○○○○	$\bar{x}$ ○	
79		○○○●		○
78		●	○○	○○○○
77	○		○○	○
76			○	○
75				○○○○
74				○○○
73			○	○○
72				$\bar{x}$ ○○○○○○
71				○○○○
70				○○○
69				○○○
68				○○○
67				○
66				
65				○

be longer than the snouts of *S. lineolatus* and *S. molei*. The length of the head alone does not indicate much about snout length, and so several other measurements were made. The snout was longest in *S. heliconiae*, being equal to a distance from the ear to ahead of the center of the eye. The snout of *S. lineolatus* is shortest, being only as long as from the ear to at most, the posterior third of the eye. This measurement for *S. molei* is approximately between the other two. The mean

angle of convergence of the sides of the snout is smallest in *S. heliconiae* ( $40.0^\circ$ ), but the modal values of *S. lineolatus* ( $41^\circ$ ) and *S. molei* ( $40^\circ$ ) are comparable to it, and their other statistics do not show that *S. heliconiae* really has a more acute snout. The length of the first infra-labial relative to the interorbital width shows that *S. heliconiae*, again, has the longest snout (two IOW), however, this scale is shorter in *S. molei* (1.3–1.5 IOW) than it is in *S. lineolatus* (1.5–2.0 IOW). Lastly, the count of scales between the levels of the orbits and the rostral, mid-dorsally, is clearly greatest in *S. heliconiae* (12.4), due to the combined factors of longer snout and intrusion of small scales into the rostral notch. The average snout count is one greater in *S. molei* (10.1) than in *S. lineolatus* (9.1), probably also due to intrusion of small scales into the rostral.

Texture of dorsal scales and parietal granules, total number of escutcheon scales, and arrangement of the median subcaudal scales were useful characteristics for differentiating between species, but not for relating them (Table 1). Keeling of the parietal granules is correlated with the degree of keeling of the dorsal scales. *Sphaerodactylus molei*, in which the parietal granules are usually keeled, has relatively stronger dorsal keels than the other species.

Each species' diagnosis begins with a remark on body size for which there are two points to note. First, *S. molei* is considerably smaller than the western species which all reach a similar maximum size. Second, at least in *S. molei* and *S. lineolatus*, females tend to be larger than males (Table 4).

## HABITS AND HABITAT

Except for the isolated report of *Sphaerodactylus notatus* from Tolú, Colombia, none of the ranges of the South American species are known to overlap, though *S. heliconiae* and *S. lineolatus* come close to being sympatric (Fig. 5).

Of the few habitat notes which are available for the South American species, including notes of *S. lineolatus* from Panamá, none show any specific difference in the habitat between species. Habitat notes for Panamanian *S. lineolatus*, from archived University of Michigan field notes, indicate little specialism, at least in resting place. They include: "in a piece of wood," "on floor of indian hut," "on trunk of sapling of one inch (diameter at breast height) about 6 feet above ground," "from tree," "from main residence," under loose bark of

TABLE 4

THE DISTRIBUTIONS OF SNOUT-VENT LENGTH (SVL) IN SPHAERODACTYLUS SCAPULARIS; *S. LINEOLATUS* FROM COROZAL, PANAMÁ; *S. HELICONIAE*; AND *S. MOLEI* FROM TRINIDAD. ONE MARK EQUALS ONE SPECIMEN CLASSIFIED TO THE NEAREST MILLIMETER.

SVL	<i>scapularis</i>		<i>lineolatus</i>		<i>heliconiae</i>		<i>molei</i>	
mm	♂	♀	♂	♀	♂	♀	♂	♀
33		○						
32				○○○○				
31				○○	○○	○○○		
30			○○	○	○			
29	○		○○○○○○○	○○○○	○	○		
28			○○○○○○○	○○		○	○	○○○
27	○		○	○○				○○○
26			○○				○	○○○
25			○				○○○○	○○
24	○			--- juv.			○○○○	○○
23				○			○○○○	○
22	?						○○○	○○
21							○	○○
20				○○				--- juv.
19								○○
18								○○
17								○
16								
15				○				
14				○○○				
13								

dead tree," "on base of large tree in disturbed gallery forest," "on buildings," "trailer," and "inside building."

Cope's name "*casicolus*" implies house-dweller, which is well supported by the above notes. There are a number of *Sphaerodactylus* (mostly *S. millepunctatus*) in the U.S. National Museum collection which were received via banana importation, suggesting banana plants as habitat. A *S. lineolatus* was caught "in a banana tree" by Frederico Medem.

I have collected series of *Sphaerodactylus* in two South American habitats not previously reported. *Sphaerodactylus lineolatus*—ICN 3218-3221, Colombia: Sucre; 9 km N of Toluviéjo then 1-2 km by road East to a hill before a small village called La Pichi; 28 July 1978; at midday. These were found by stripping decayed petiole stumps off palm trees. Other reptiles found in this manner were *Gymnophthalmus*

*speciosus*, *Gonatodes albogularis* and *Imantodes cenchoa*. The region was comprised of flat cleared agricultural lands interspersed with rugged heavily forested, limestone ridges.

The Candelaria—Río Frío series of *Sphaerodactylus heliconiae* was collected at midday while cutting down part (ca. 10 m<sup>2</sup>) of an emergent stand of *Heliconia* sp. (Musaceae) beneath a large fig tree, *Ficus alba*. The tree harbored *Gonatodes albogularis*. The sphaerodactyls were found floating on the water where the heliconias had fallen or in a canoe in which the cut plants were placed, apparently having fallen from the 4 m high heliconias. It was later noted that the gekkos' ability to cling to smooth *Heliconia* cuticle was rather poor. The type locality of *S. heliconiae* is on the edge of the Ciénaga Grande estuary and is usually inundated by fresh water.

### SUMMARY

The four native South American species of *Sphaerodactylus*, *S. lineolatus*, *S. molei*, *S. scapularis*, and *S. heliconiae*, n. sp., are diagnosed. Their interspecific similarities, geographical distributions, and certain aspects of their ecologies are discussed. In addition, literature reports of other species of *Sphaerodactylus* from South America are evaluated, and *S. notatus* is reported from the continent for the first time.

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FMNH—Field Museum of Natural History, Chicago; Hymen Marx and Alan Resetar.

ICN—Instituto de Ciencias Naturales, Universidad Nacional, Bogotá; Pedro Ruíz.

INDR—Instituto de Recursos Naturales Renovables y del Ambiente, Bogotá; Hernando Chiriví and Vicente Rodríguez.

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MVZ—Museum of Vertebrate Zoology, University of California, Berkeley; Harry Greene and David Wake.

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