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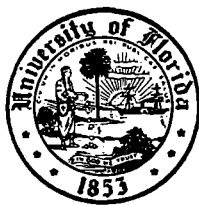
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**SYSTEMATICS OF LESSER ANTILLEAN LIZARDS
OF THE GENUS SPHAERODACTYLUS**

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SYSTEMATICS OF LESSER ANTILLEAN LIZARDS OF THE GENUS *SPHAERODACTYLUS*

WAYNE KING¹

SYNOPSIS: Poor descriptions, resulting in the misapplication of names, and the unneeded multiplicity of recognized forms has confused the taxonomy of the lizard genus *Sphaerodactylus* in the Lesser Antilles. Examination of specimens available from the area shows eight species to occur. Each is described and illustrated, and its known range listed. The presence of two species in the type series of *S. sputator* necessitates the designation and description of a lectotype. Two new races, *S. macrolepis parvus* and *S. fantasticus ligniservulus* are described from the northern Lesser Antilles. *S. festus* is treated as a subspecies of *S. vincenti* and is shown to include variation thought distinctive of *S. monilifer*.

The sphaerodactyls of the Lesser Antilles are believed to have immigrated into the islands from continental South America. The most probable means of dispersal available to them is rafting.

¹The author is a John M. Prather Fellow in the Department of Zoology of the University of Chicago. This paper represents, in part, a thesis prepared in partial fulfillment of the requirements for the degree of Master of Science in the Department of Biology of the University of Florida. Fieldwork for this study was supported by the Florida State Museum and National Science Foundation grant G-3896. Manuscript submitted 10 February 1962. The author was unable to examine proofs of this article before publication.—Ep.

INTRODUCTION

In 1784 Anders Sparrman described the lizard *Lacerta sputator* (= *Sphaerodactylus sputator*) from the island of St. Eustatius, Lesser Antilles. Since then a number of species of *Sphaerodactylus* have been described from other islands in the Lesser Antilles. The descriptions in most cases were based on the color pattern of one or a few specimens in the belief that this character varied little, and on the assumption that species were confined to single islands (Barbour, 1921:264). This resulted in widespread misapplication of names to species with similar color patterns, and an unfortunate multiplicity of named forms.

This study attempts to clarify the taxonomy of this group in the Lesser Antilles. I have examined most of the specimens available from the area and tried to determine the individual variation and distribution of each of the forms.

The Lesser Antilles are a discrete geographic group of islands separated from the Virgin Islands to the north by the Anegada Passage, and from Trinidad and Tobago to the south by the Tobago Trough. They also represent the present zone of contact between typically Antillean and typically South American species.

The species of *Sphaerodactylus* that occurs on Trinidad and Tobago appears to be related to species in the southern Lesser Antilles. For this reason I have included these two islands in the study area, even though they are not a part of that island chain. The study includes, from north to south, the islands of Sombrero, Dog Island, Anguilla, Tintamarre, St. Martin, Ile Fourche, St. Barts (= St. Barthelemy, = St. Bartholomew), Saba, Statia (= St. Eustatius), St. Kitts (= St. Christopher), Nevis, Barbuda, Antigua, Redonda, Montserrat, Guadeloupe, Désirade, Îles des Saintes, Marie Galante, Dominica, Martinique, St. Lucia, St. Vincent, Barbados, The Grenadines, Grenada, Tobago, and Trinidad.

ACKNOWLEDGMENTS

I wish to thank Wm. J. Riemer and W. Auffenberg for their continued patience, interest, and criticism, and for making it possible for me to visit some of the Lesser Antilles in order to collect many of the specimens used in this study. I would like to thank M. Boeseman, C. M. Bogert, D. M. Cochran, J. Guibé, N. Hartweg, P. W. Hummelinck, R. F. Inger, A. Johnels, G. Underwood, and E. E. Williams for the loan of specimens in their care. Thanks are also due D. A. Belkin and P. C. Drummond for their enthusiasm and interest in West Indian zoogeography.

MATERIALS AND METHODS

The characters used in this study are defined as follows:

SHAPE OF DORSAL SCALES. The dorsal scales fall into four general groups based on shape—large keeled scales, keeled granular scales, granules, and smooth scales. Only the first three of these scale types are found in the study area. The large keeled scales, granular scales, and smooth scales imbricate, while granules are juxtaposed.

MIDDORSAL AREA OF GRANULES. An area of juxtaposed granules in a middorsal (vertebral) band on the trunk. Although the area of granules may be present in species possessing small granular scales, it is well defined only when associated with the larger scale types—large keeled scales and keeled granular scales. The width of this area is expressed as the number of transverse scale rows (granules).

SCALES FROM AXILLA TO GROIN. The number of scales beginning with one lying on a line with the posterior edge of the forelimb counted caudad to one lying on a line with the anterior edge of the hindlimbs. Dorsal scales are counted in a dorsolateral position to avoid the middorsal granules of some species. Ventral scales are counted along a midventral line.

MICROSCOPIC STRUCTURE OF DORSAL SCALES. The presence or absence of knoblike or "hair-bearing" scale organs on the dorsal surface (fig. 1 A¹ to A⁴). These scale organs are also found in other groups of lizards (Schmidt, 1920:113; Underwood, 1957:277). In *Sphaerodactylus* they occur on other scales of the body, but only the dorsal scales of the trunk are used in this study. These structures are observed by removing loose dorsal scales (the corneal layer of the epidermis which is shed during ecdysis) from the specimen and mounting them in air on a slide. The indices of refraction of the scales and conventional mounting media are close enough to obliterate much of the detailed structure on the scale.

SHAPE OF VENTRAL SCALES. The ventrals are keeled or smooth, acute or round.

SCALE ROWS AROUND MIDBODY. The number of scale rows around the middle of the trunk, including middorsal granules, if present.

INTERNASALS. The number of scales lying between the supranasals, and in contact with the rostral scale.

UPPER LABIALS. The number of upper labials, counted from the labial touching the rostral scale caudad to a point directly below the center of the eye. The count is made on the right side.

GULAR SCALES. These scales are smooth, keeled on the sides of the

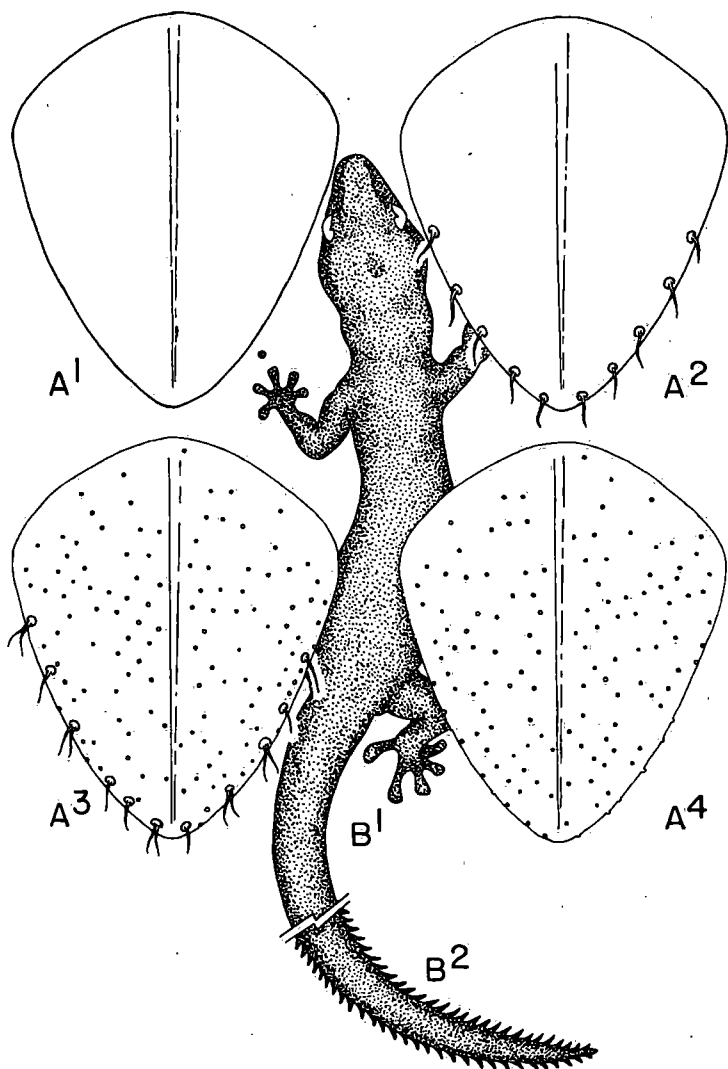


FIGURE 1. Types of dorsal scale organs and dorsal caudal scutellation. (A¹) no scale organs; (A²) hair-bearing organs with one hair each; (A³) knoblike organs and hair-bearing organs, with one or two hairs each (some species have more hairs); (A⁴) knoblike organs; (B¹) caudal scales lie flat against the tail, or (B²) stand erect from the tail.

throat, keeled in a band (collar) across the throat, or keeled across the throat and caudad to the chest and abdomen.

LAMELLAE OF FOURTH TOE. The number of lamellae under the fourth toe of the right foot, exclusive of the terminal expanded disk, counted proximally to the last large, expanded lamella (fig. 5 A).

MIDVENTRAL SCALE ROW OF TAIL. The scales of the midventral row of the tail are transversely expanded into plates (shields), enlarged (larger than adjacent rows, but not wide plates), or unexpanded (same width as the lateral and dorsal rows). Because regeneration alters this character, only specimens with original tails were used in this count.

DORSAL SCALES OF TAIL. These scales generally lie flat against the tail (fig. 1 B¹), but in some species they stand erect (fig. 1 B²) giving the tail a rough appearance. This is not an artifact caused by dehydration in preserving fluid. Only specimens with original tails were used for this character.

PRESACRAL VERTEBRAE. The number of vertebrae, counted from the atlas caudad to, but not including, the first sacral vertebra with expanded diapophyses in contact with the ilium. This count is made from roentgenograms. A total of 318 specimens of the species examined (including all type specimens examined) were counted.

ESCUTCHEON OF MALE. The area of differentiated glandular scales in the inguinal region of the males has been called the escutcheon (Grant, 1931:199). The width of the escutcheon is the number of scale rows at its greatest width, including extensions along the thighs. The length is the number of scales on the midventral line counted from the anteriormost to the posteriormost.

SNOUT-VENT LENGTH. The distance from the tip of the snout to the anterior margin of the cloaca. The total length is not given for most of the species as many individuals have broken or regenerated tails. The total length corresponds roughly to twice the snout-vent length. Snout-vent length is measured with calipers and millimeter rule.

Individuals are sexed by secondary sex characters, primarily the escutcheon of the male. Noble and Klingel (1932:15) state that the presence of the escutcheon is:

... less diagnostic of sex than another male character which we believe has not been hitherto described. The posterior lip of the cloaca is very much broader in the adult male than in the adult female. Most females ... have the cloaca closed and exhibit little or no fleshy margin to the caudal side of the cloaca. Most males ... have this fleshy margin broader and exhibit a tendency for it to fold back towards the tail.

Noble and Klingel themselves point out the weakness of this cloacal character in determining sex, as poorly preserved male specimens do

not show the opened cloaca. Examination of a series of specimens shows this method inadequate, owing to the large number of poorly preserved specimens.

Grant (1932:405) states that:

My study of a series of 2,035 specimens of nine species from the Puerto Rico Area has shown that the escutcheon is visible in newly hatched specimens and not confined to "adults."

Examination of the specimens used in this study (including a number of those Grant used in his study) fails to show the escutcheon in any individual of less than 18 mm. snout-vent length, though juveniles of 13 to 15 mm. snout-vent length are plentiful. The smallest adult size given in each species description is based on the snout-vent length of the smallest specimen with an escutcheon.

The number of dorsal scales equivalent in length to the "standard length" (snout-eye length), has previously been used to indicate the relative size of the dorsal scales. Juvenile individuals, however, have relatively larger heads than do adults, and consequently have more dorsal scales contained in their "standard length." Grant (1959a:57) shows how this led to the description of the juveniles of *S. cinereus* as a separate species (*S. elegans*)—the juveniles have 24 to 25 dorsal scales in the "standard length"; the adults, 18 to 19. The measure of relative scale size that I used, the number of scales from axilla to groin, is fairly constant within a species, and does not vary ontogenetically.

Individual color patterns of these animals vary as widely as any morphological character in the populations. In an effort to include total color pattern variation of each of these forms I use only generalized terms in the color descriptions. Colors are grouped into three categories—light, medium, and dark. Except where stated, all color descriptions refer to alcohol specimens. Each species description is accompanied by an illustration that shows the total observed variation in color pattern.

Except in the case of the types of three species, descriptions of individuals are not given, instead reference is made to the species as a whole. In these three special cases the descriptions of the types also contain, in parentheses following each character, the variation which occurs within the species. The description and variation of the species is based on the total observed variation in the material examined.

Throughout this paper the following abbreviations are used to refer to specimens or collections:

- AMNH—American Museum of Natural History, New York
CNHM—Chicago Natural History Museum, Chicago
MCZ—Museum of Comparative Zoology, Cambridge, Massachusetts
MNHN—Muséum National d'Histoire Naturelle, Paris, France
PWH—P. Wagenaar Hummelinck collection, Utrecht, Netherlands
RMNH—Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands
SMNH—Naturhistoriska Riksmuseet, Stockholm, Sweden
UF—University of Florida Collections, Gainesville, Florida
UMMZ—University of Michigan Museum of Zoology, Ann Arbor, Michigan
USNM—U.S. National Museum, Washington, D.C.

Comparative material in the genus *Sphaerodactylus* used includes:

- S. anthracinus anthracinus*, New Providence, Bahamas
S. anthracinus copei, Haiti
S. altavelensis, Alta Vela Island, Dominican Republic
S. argivus, Cayman Brac
S. argus, Jamaica
S. bartschi, Little Cayman Island
S. beattyi, St. Croix, Virgin Islands
S. becki, Navassa Island, Haiti
S. caicosensis, Caicos Islands, Bahamas
S. cinereus, Florida
S. difficilis, Dominican Republic
S. dunni, Honduras
S. gaigei, Puerto Rico
S. glaucus, Mexico
S. goniorhynchus, Jamaica
S. lewisi, Grand Cayman Island
S. lineolatus, Costa Rica
S. notatus, Florida
S. oliveri oliveri, Cuba
S. oxyrrhinus, Jamaica
S. pacificus, Cocos Island, Costa Rica
S. parkeri, Jamaica
S. ramsdeni, Cuba
S. richardsoni gossei, Jamaica
S. roosevelti, Puerto Rico
S. stejnegeri, Haiti
S. townsendi, Puerto Rico

SYSTEMATICS

Several closely related Antillean forms are considered here as subspecies. Because they comprise insular populations separated from each other by open ocean, no intergradation can occur. Nevertheless the great similarity in color patterns and other morphological characters suggests strongly that if the animals were not physically separated they would probably interbreed freely.

KEY TO THE SPECIES OF SPHAERODACTYLUS IN THE LESSER ANTILLES

- 1 Ventral scales keeled on abdomen 2
 Ventral scales not keeled 3
- 2 Caudal scales stand erect, imparting fuzzy appearance to tail; midventral tail row not expanded; no middorsal area of granules; 42-53 dorsal scales from axilla to groin; St. Lucia and Dominica *S. microlepis*
 Caudal scales lie flat against tail; midventral tail row expanded into transverse plates; middorsal area of granules present; 23-29 dorsal scales from axilla to groin; Guadeloupe *S. fantasticus*
- 3 Well-defined middorsal area of granules 4
 No well-defined middorsal area of granules 7
- 4 Gular scales smooth; dorsal scales with hair-bearing scale organs only; snout-vent length 15-36 mm.; Statia, Dog Island, St. Martin, St. Barts, Ile Fourche, St. Kitts, and Nevis *S. sputator*
 Gular scales keeled, at least on sides of throat; dorsal scales with both hair-bearing and knoblike scale organs; snout-vent length 13-29 mm 5
- 5 Presacral vertebrae 27; 33-42 dorsal scales from axilla to groin; 47-66 scale rows around midbody; Statia, St. Kitts, and Nevis *S. sabanus*
 Presacral vertebrae 26; 23-38 dorsal scales from axilla to groin; 41-54 scale rows around midbody 6
- 6 Gular scales keeled on side of throat, or in narrow band across throat; juvenile pattern of crossbands, adult pattern uniform brown or vermiculated; Antigua and Barbuda *S. elegantulus*
 Gular scales strongly keeled on entire throat, keeled scales may extend caudad to the chest; juvenile and adult pattern of longitudinal stripes, or uniform brown; Guadeloupe and Montserrat *S. fantasticus*
- 7 Dorsal scales large, keeled, and strongly imbricate, 20-29 from axilla to groin; 40-51 scale rows around midbody; Anguilla, Dog Island, St. Barts, St. Martin, and Tintamarre *S. macrolepis*
 Dorsal scales weakly keeled, and only slightly imbricate, 36-74 from axilla to groin; 53-82 scale rows around midbody 8
- 8 Dorsal scales with only hair-bearing scale organs; 64-74 dorsal scales from axilla to groin; Trinidad, Tobago, British Guiana, and Venezuela *S. molei*
 Dorsal scales with both hair-bearing and knoblike scale organs; 36-54 dorsal scales from axilla to groin; St. Vincent, St. Lucia, Dominica, and Martinique *S. vincenti*

SPECIES DESCRIPTIONS

Sphaerodactylus sputator (Sparrman)

Lacerta sputator Sparrman, 1784:164. (in part).

Sphaerodactylus pictus Garman, 1887:20.

Sphaerodactylus sputator Andersson, 1900:27 (in part); Barbour, 1921:266 (in part); Barbour, 1923:2 (in part).

Anders Sparrman (1784:164) described *Lacerta sputator* (= *Sphaerodactylus sputator*) from the island of Statia on the basis of three syntypes in the Swedish Museum of Natural History, Stockholm. He described *sputator* as an ash-gray lizard with brown-edged white crossbands on the dorsum (hereafter in this discussion it will be called variation 1—it corresponds to plate 4, fig. 1 of Sparrman's description). The smallest of the three syntypes lacked the white crossbands and had brown spots instead (variation 2 in this discussion—plate 4, fig. 2 of Sparrman's description). Sparrman described this small specimen as a "larval," i.e. juvenile, variation of the typical adult pattern, because the tail, which was actually being regenerated, was not yet completely formed.

The island of Statia was visited so infrequently that the species was not collected there again for 138 years. This led many later authors to apply the name *Sphaerodactylus sputator* to crossbanded sphaerodactyls from other islands in the Antilles. Andersson (1900:27), in an attempt to clarify the situation, re-examined the three types and stated that two possessed the characteristic crossbands (variation 1); the third (variation 2) was not described. Barbour (1914:270) pointed out some of the confusion surrounding the identity of *sputator* and said he believed the species was probably confined to the island of Statia. Later (1921:266) Barbour encouraged Andersson to supply the description of the types for his monograph of the genus. Andersson described the syntypes as:

... *Two specimens* ... Head above indistinctly dotted with brown; between ear and vent of pairs of brown bands, the first immediately behind the ear, 2nd in front of, 3rd behind, the axilla, 4th, 5th and 6th on the body, 7th at the vent. The basal part of the tail is provided with 6-8 bands, more or less distinctly arranged in pairs; the distal part shows no bands only small dots, in one specimen it is regenerated.

The smallest specimen ... has no bands. The head and upper surface of the neck is very distinctly and densely spotted with brown; the anterior part of the body indistinctly dotted.

In that publication the largest and smallest of the syntypes are figured (plate 8, figs. 3 and 4), clearly showing the crossbanding of the large specimen (variation 1) and the vermiculation of the small one (variation 2).

On re-examining Sparrman's types of the species (fig. 2) I find two species present—two large specimens (variation 1) are of the species now called *Sphaerodactylus sputator* (Sparrman), and the small specimen (variation 2) is of the species now called *Sphaerodactylus sabanus* Cochran. The smallest specimen has 27 presacral vertebrae, keeled gular scales on the sides of the throat, and has both knoblike and hair-bearing scale organs on the surface of the dorsal scales. The two large specimens have 26 presacral vertebrae, smooth gular scales, and only hair-bearing scale organs on the dorsal scales. King (1960:2) points out that Barbour (1923:2) similarly confused the two species in a series of specimens collected on Statia in 1922 by James L. Peters. Barbour stated that *sputator* was dichromatic—the females (actually

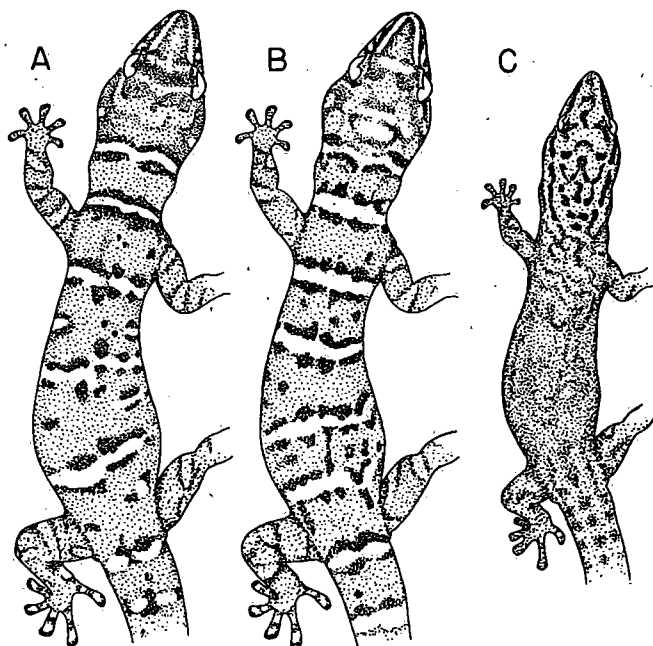


FIGURE 2. Syntypes of *Lacerta sputator* Sparrman (= *Sphaerodactylus sputator*). (A) SMNH 2670; (B) SMNH 2669; (C) SMNH 2671. A and B are of the species now called *S. sputator*, C is *S. sabanus*. B is the newly designated lectotype of *S. sputator*. Relative size and position of the specimens in this and the following figures is diagrammatic to facilitate comparison of color patterns.

sputator) large and with crossbands and blotches, the males (*sabanus*) small and uniform gray brown.

The largest specimen of the type series is here redescribed and designated as the lectotype of *Sphaerodactylus sputator* (Sparman).

DIAGNOSIS. A large sphaerodactyl with large, keeled, and slightly imbricate dorsal scales, and a middorsal area of granular scales. The dorsal scales with hair-bearing scale organs on their surface. Ventrals smooth and round. Gulars smooth. Internasals 1, upper labials 3. Dorsal scales of tail imbricate, but lie flat against tail. Presacral vertebrae 26. Groundcolor light brown. Pattern of dark brown-edged white crossbands, dark brown blotches, or dark brown longitudinal stripes.

LECTOTYPE. SMNH 2669, an adult female, collected by Dr. Acrelius in 1755 on the island of Statia (fig. 2 B).

DESCRIPTION OF LECTOTYPE (AND SPECIES). Dorsal scales large, keeled, acute to round, and slightly imbricate; 34 axilla to groin (31-39 in other specimens, mean 34.6). Hair-bearing scale organs, each with 1 to 2 hairs, along dorsodistal edge of dorsal scales. Area of middorsal granular scales present, 2 scale rows wide. Ventrals smooth and round; 29 axilla to groin (27-34 in other specimens, mean 30.3). Gulars smooth. Scale rows around midbody 56 (49-62 in other specimens, mean 55.5). Internasals 1 (1-2, mode 2). Upper labials 3 (3-4, mode 3). Lamellae of fourth toe 10 (8-12, mode 10). Escutcheon of male (the lectotype is a female) 26 to 30 scales wide, 3 to 6 scales in length. Dorsal scales on tail weakly keeled and imbricate, and lie flat against tail. Midventral row transversely expanded into plates. Presacral vertebrae 26. Snout-vent length 36 mm. (snout-vent length of smallest juvenile is 15 mm.; adults 20 to 36 mm., mean 31.5).

The dorsal groundcolor is light brown. The pattern consists of six brown-edged, dull-white crossbands between the head and the groin (fig. 2 B). The crossbands continue onto the tail but are ill-defined and obscure. The entire animal has a slight greenish cast, as though it had been exposed to the corrosion products of zinc or brass.

The throat has a small hole punctured between the mandibles. The tail is broken off close behind the vent, and is loose in a vial with the lectotype (the tail itself has been broken into two pieces now held together by a pin running longitudinally through them).

In other individuals the pattern exhibits neither sexual dichromatism nor ontogenetic variation. The groundcolor is light brown with 5 to 8 dark brown-edged white crossbands between the head and groin (2-4 on the head and neck, 3-4 on the trunk). In some individuals the brown edges invade the white crossbands creating a brown and

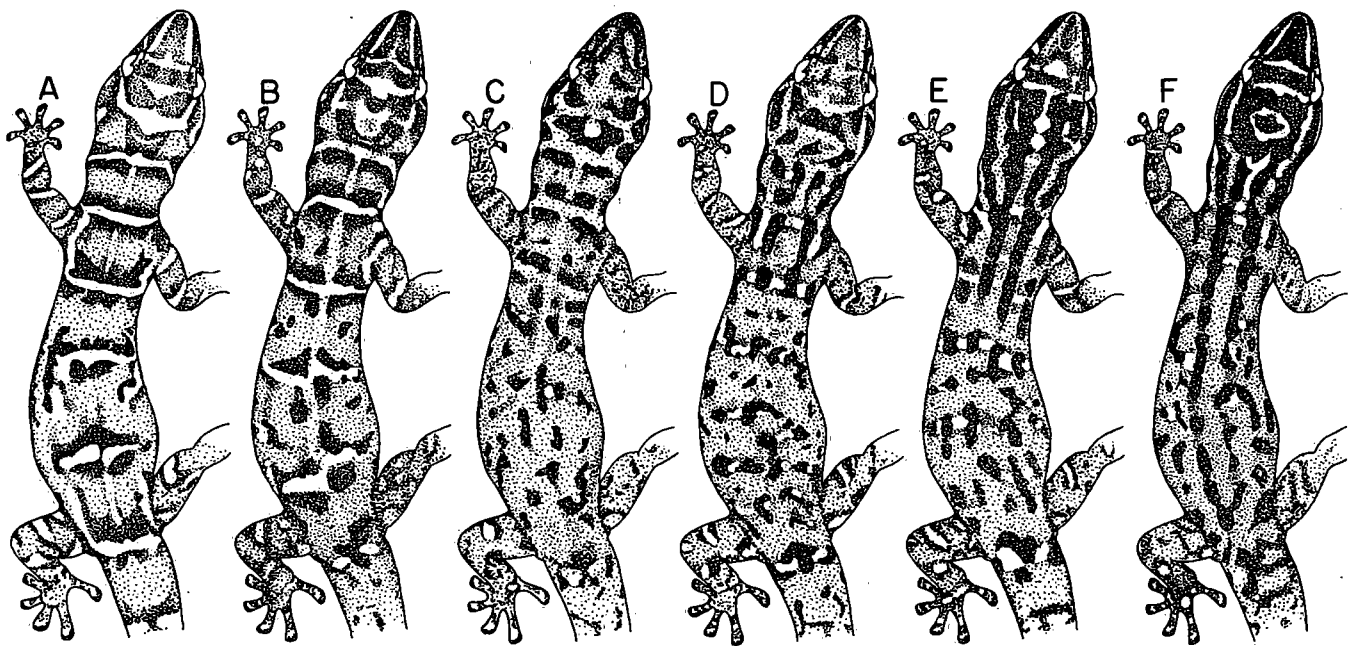


FIGURE 3. Variation in the markings of adult *Sphaerodactylus sputator*. (A) RMNH 10456; (B) RMNH 10456; (C) UF 10039.1; (D) MCZ 16614; (E) MCZ 16622; (F) MCZ 16611.

white spotted animal. In others the brown edges not only invade the white crossbands, but also realign and fuse into dorsolateral stripes creating a longitudinally striped animal. All of these variations in pattern are shown in figure 3.

RANGE. The islands of Statia, Dóg Island (west of Anguilla), St. Martin, St. Barts, Ile Fourche, St. Kitts, and Nevis. Its known range suggests that it probably occurs on Anguilla and Saba also.

REMARKS. A number of females collected from February to June are gravid. Each contains one mature shelled egg. Those I collected are from beneath rocks on St. Martin and from a pile of coconut husks on St. Kitts.

Its closest relationships seem to lie with *S. elegantulus*. *S. sputator* is unique in that it is the only sphaerodactyl examined during this study with a well-defined middorsal area of granules and that lacks knoblike scale organs and has only hair-bearing scale organs.

MATERIAL EXAMINED. Statia: SMNH 2669 (lectotype), 2670; MCZ 16598-16633, 16635-16641 (30); RMNH 10451; UMMZ 57010. St. Kitts: MCZ 6071 (3); UF 10038. Nevis: RMNH 10449. St. Martin: PWH 474A, 606; RMNH 10436, 10437, 10439 (3), 10440, 10441 (2), 10442, 10443, 10445 (2), 10456 (2), 10457, 10458, 10459, 10460 (4), 10462, 10464; UF 10039 (2). St. Barts: RMNH 10435, 10453 (2). Ile Fourche: RMNH 10455. Dog Island: RMNH 10446 (3).

Sphaerodactylus sabanus Cochran

Lacerta sputator Sparman, 1784:164 (in part).

Sphaerodactylus sputator Andersson, 1900:27 (in part); Barbour, 1921:266 (in part).

Sphaerodactylus sabanus Cochran, 1938:148.

DIAGNOSIS. A sphaerodactyl with keeled, granular scales and a mid-dorsal area of granular scales. Dorsal scales with both knoblike and hair-bearing scale organs. Ventrals smooth and round. Gulars keeled. Internasals 1 to 3, upper labials 3. Dorsal scales on tail imbricate, but lie flat against tail. Presacral vertebrae 27. Groundcolor brown, dark to light. Pattern of longitudinal dark stripes on head and body and light dorsolateral stripes on tail, or dark vermiculate markings on head, or uniform brown head and body.

HOLOTYPE. USNM 103985, an adult male collected by S. T. Danforth on the island of Saba in January 1937.

DESCRIPTION OF SPECIES. Dorsal scales keeled and granular, slightly imbricate; 33 to 42 axilla to groin, mean 38.0. Dorsal scales with knoblike scale organs and hair-bearing scale organs, each with 1 to 3 hairs. An area of middorsal scales present, 1 to 2 scale rows wide. Ventrals

smooth and round; 28 to 33 axilla to groin, mean 30.7. Gulars keeled, at least on the sides of throat. Scale rows around midbody 47 to 66, mean 57.6. Internasals 1 to 3, mode 2. Upper labials 3. Lamellae of fourth toe 7 to 11, mode 9. Escutcheon of male 22 to 28 scales wide, and 5 to 6 scales long. Dorsal scales of tail keeled, acute to round, imbricate, but lie flat against tail. Midventral row transversely expanded into plates. Presacral vertebrae 27. Snout-vent length of smallest juvenile is 15 mm., adults 20 to 29 mm., mean 25.2.

The pattern shows neither sexually dichromatic nor marked ontogenetic variation. The dorsal groundcolor is light to dark brown. A dark brown stripe extends from the nostril through the eye and onto the neck, where it swings toward the midline and fuses with the one from the opposite side just anterior to the scapular region. A dark brown line extends from the tip of the snout caudad between the eyes, where it divides, each half passing to a point immediately posterior to the eye. Each then continues caudad and returns toward the midline, circles an occipital spot, and fuses with the dark lines from the opposite side just anterior to the scapular region and the point of fusion of the dark postorbital stripes (fig. 4 A). The occipital spot is usually a dark brown to black spot, or is a white spot with a dark edge. The pattern on the trunk consists of a dorsolateral row of light brown to white spots, which become more pronounced in the sacral

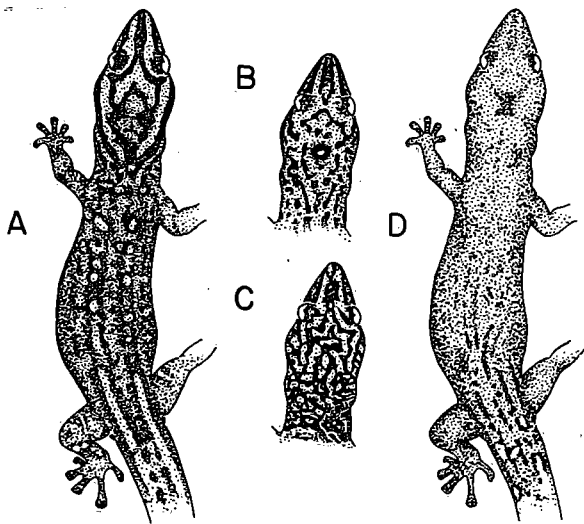


FIGURE 4. Variation in the markings of adult *Sphaerodactylus sabanus*. (A) UF 10045.1; (B) MCZ untagged specimen in series 54010-54015; (C) UF 10042.3; (D) UF 10044.7.

region and are united to form white stripes on the tail. In some individuals the dark head stripes break up to form a series of spots roughly suggesting the original pattern (fig. 4 B), or they fuse with one another to form a vermiculate head pattern (fig. 4 C). Other specimens, both juveniles and adults, are uniform brown (fig. 4 D). The ventral color is light brown to white. The juvenile pattern is identical to the adult pattern except that the longitudinal stripes on the head of the juveniles seem to be slightly more pronounced, and the vermiculate head pattern of some adults is more pronounced.

RANGE. The islands of Saba, Statia, St. Kitts, and Nevis.

REMARKS. Females collected during May and June have mature, shelled eggs in their oviducts. I took specimens under rocks on St. Kitts and beneath coconut husks and palm fronds on Nevis.

As pointed out in the discussion of *S. sputator*, *S. sabanus* is often confused with that species because the two seem to occupy the same microhabitat and are often collected together. King (1960:4, see also Barbour, 1929:81) shows that *S. sabanus* is often confused with *S. elegantulus* from Antigua and Barbuda because of the superficial similarity between uniform brown adults of the two species. They are undoubtedly closely related. *S. sabanus* differs from all other sphaerodactyls I have examined in having 27 presacral vertebrae—all other forms examined have 26.

MATERIAL EXAMINED. Saba: USNM 103985 (holotype), 103986, 103988-103993, 103995-104003; MCZ 45215-45217; RMNH 10433 (2), 10434, 10452. Statia: MCZ 54010-54015 (158); RMNH 10432 (4), 10450 (2); SMNH 2671. St. Kitts: PWH 422; UF 10041 (9), 10042 (9), 10043 (9), 10044 (9), 10045 (10); UMMZ 83317. Nevis: MCZ 38374; PWH 414; RMNH 10431, 10448; UF 10040 (3).

Sphaerodactylus macrolepis Günther

Sphaerodactylus macrolepis Günther 1859:215.

DIAGNOSIS. A sphaerodactyl with large, acute, strongly keeled, imbricate scales, and with no middorsal area of granules. Dorsal scales with hair-bearing scale organs on their dorsodistal edges. Ventrals smooth on abdomen, may be keeled on chest. Gulars keeled. Internasals 1 to 2; upper labials 3. Dorsal scales on tail imbricate, but lie flat against tail. Presacral vertebrae 26. Groundcolor brown, light to medium. Pattern a black ocellus, containing one or two white spots, in scapular region. Trunk with 4 to 6 dark longitudinal stripes, or scattered dark scales. Suprapostorbital dark stripes encircle the dark occipital spot and may be fused together to form a crude V on head

and neck, or may be fused with scapular ocellus, or may converge but remain slightly apart.

KEY TO THE SUBSPECIES.

Ventral scales keeled on chest or anterior abdomen; adult snout-vent length 18-24 mm.; scapular ocellus reduced or absent; dark scales on dorsum scattered at random; St. Martin, St. Barts, Anguilla, and Dog Island.

----- *Sphaerodactylus m. parvus*, new subspecies

Ventral scales smooth, only gulars keeled; adult snout-vent length 18-28 mm.; scapular ocellus usually large, may be reduced or absent; dark scales on dorsum arranged in 4-6 longitudinal rows or absent; Virgin Islands.

----- *Sphaerodactylus m. macrolepis*

(As this subspecies does not occur in the Lesser Antilles, it is not discussed further.)

Sphaerodactylus macrolepis parvus, new subspecies.

HOLOTYPE. UF 10034.1, an adult male collected by Wayne King, on the island of St. Martin, 2-1/2 miles west, 1/4 mile north of Philipsburg, 16 July 1958 (fig. 5).

DESCRIPTION OF HOLOTYPE (AND OF SUBSPECIES). Dorsal scales large, acute, strongly keeled, and imbricate; 27 axilla to groin (23-29 in

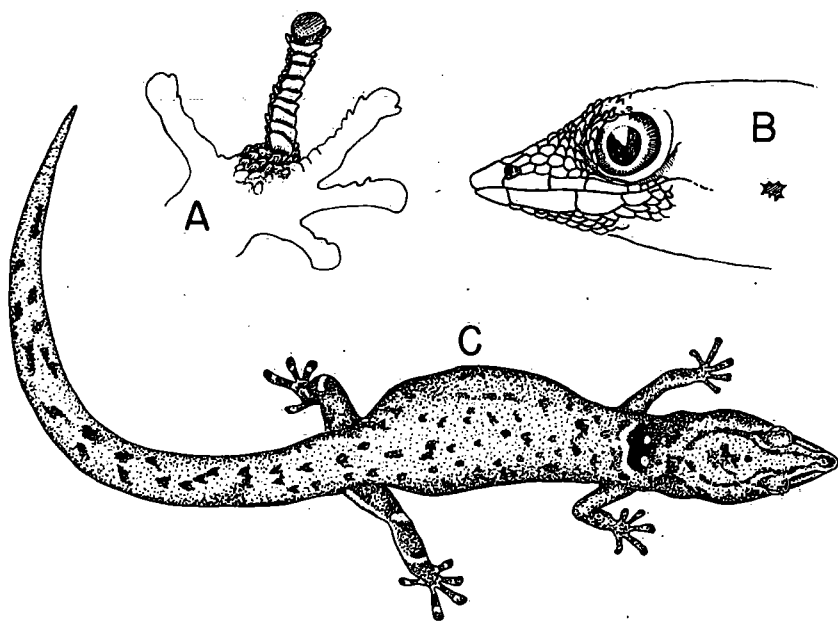


FIGURE 5. Holotype of *Sphaerodactylus macrolepis parvus*, new subspecies—UF 10034.1. (A) subdigital lamellae of fourth toe, right pes; (B) scutellation of head; (C) dorsal markings.

other individuals, mean 25.9). Dorsal scales with hair-bearing scale organs, with one hair each, along dorsodistal edge. No middorsal area of granules. Ventrals smooth and round (keeled on sides of abdomen in some specimens); 29 axilla to groin (26-29 in other specimens, mean 27.5). Scale rows around midbody 50 (45-51 in other specimens, mean 48.4. Internasals 1 (1-2, mode 1). Upper labials 3. Lamellae of fourth toe 9 (9-11, mode 10). Escutcheon 19 scales wide (19-25 in other specimens), 5 scales long (4-7 in other specimens). Dorsal scales of tail keeled, imbricate, and acute to round, but lie flat against tail. Midventral row transversely expanded into plates. Presacral vertebrae 26. Snout-vent length 22 mm. (smallest juvenile is 13 mm.; adults 18-24 mm., mean 21.7)

The pattern shows neither sexual dichromatic nor ontogenetic variation. The dorsal groundcolor is a light to medium brown. A dark brown stripe extends from the nostril through the eye into the side of the neck where it fades. A pair of dark stripes extend caudad from the tip of the snout to a point between the eyes where they diverge from the midline and fuse with a suprapostorbital dark stripe immediately posterior to the eye. These stripes then continue caudad and circle a dark occipital spot and nearly meet. The caudal ends of these stripes are separated by three scale rows (in a few individuals the ends fuse). A black ocellus in the scapular region contains two white spots in its center and has a light brown caudal border (in some

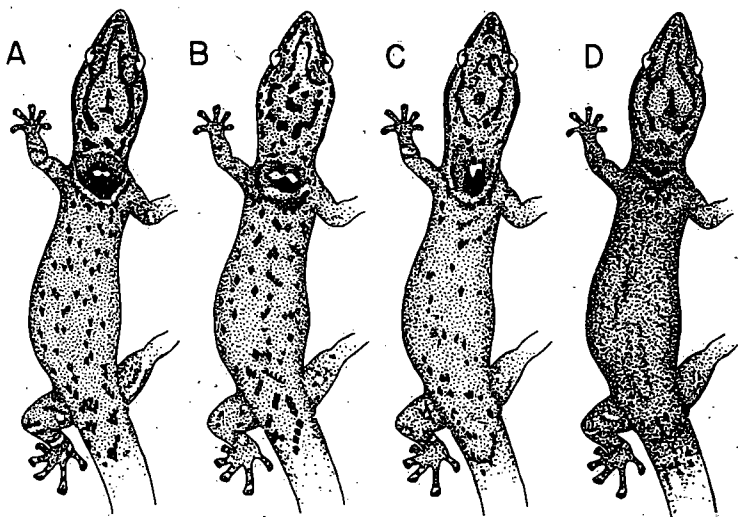


FIGURE 6. Variation in the markings of adult *Sphaerodactylus m. parvus*. (A) UF 10035; (B) PWH 474A; (C) UF 10036.2; (D) UF 10036.1.

individuals the two white spots fuse to form spectacles [fig. 6 A and B], or the ocellus contains only one white spot [fig. 6 C], or the ocellus is obscure or absent [fig. 6 D]). The venter is a uniform dull white; the chin is speckled with brown.

RANGE. The islands of Anguilla, Dog Island, St. Barts, St. Martin, and Tintamarre.

REMARKS. Single mature eggs occur in the oviducts of several females collected during June and July. I collected the species beneath rocks in a cave on Anguilla, and in the leaf litter under rocks in a cave, and under the rocks from a stone wall on St. Martin. One egg was present with the geckos from the cave on St. Martin; it measured 6 mm. in length and 4.5 mm. in diameter.

S. m. parvus and *S. m. macrolepis* are closely related to *S. notatus*, *S. grandisquamis*, and *S. difficilis*, which probably represent races of the same species.

MATERIAL EXAMINED. *S. macrolepis parvus* (paratypes)—St. Martin: MCZ 39741; PWH 474A (5); RMNH 10438 (3), 10444, 10461 (3), 10463; UF 10034 (10), 10035. Anguilla: RMNH 10447; UF 10036 (6), 10037 (2). Dog Island: RMNH 10466. Tintamarre: RMNH 10465. St. Barts: RMNH 10454. *S. macrolepis macrolepis*—St. Croix: AMNH 39270-39273; MCZ 10725-10732; PWH 614 (5), 617, one unnumbered specimen; RMNH 6672 (4), 6675 (3), 6676 (6), 6679 (3); UMMZ 46750-46752 (17), 46759, 56016 (4), 73628 (5), 80550 (11), 80553-80554 (13), 80556 (4), 80557 (9), 80558. St. Thomas: CNHM 42081-42087; PWH 621, 623; RMNH 6674, 6681 (3), 6682 (2), 9174; UMMZ 73608-73609, 80547 (3), 80549 (8), 80559 (2), 80561 (3), 80562 (2), 80563, 80566 (3), 80629. St. John: MCZ 34537-34545 (14); PWH 618, 618A, 619; RMNH 6678 (3); UMMZ 73633 (10), 80551 (7). Tortola: CNHM 11288 (9); RMNH 6673 (20), 6677 (4); UMMZ 73607 (20), 73907 (20), 80548 (19), 80564, 80565 (2). Virgin Gorda: MCZ 12256-12259; RMNH 6671 (8); UMMZ 80550 (20). Anegada: MCZ 12260-12263; UMMZ 80784 (20).

Sphaerodactylus elegantulus Barbour

Sphaerodactylus fantasticus Boulenger, 1885:223 (in part).

Sphaerodactylus elegantulus Barbour, 1917b:163; Barbour, 1921:269.

DIAGNOSIS. A sphaerodactyl with large, acute, strongly keeled, imbricate scales, and an area of middorsal granular scales. Dorsal scales with knoblike and hair-bearing scale organs. Ventrals smooth and round. Gulars keeled on sides of throat. Internasals 1 to 3, upper labials 3. Dorsal scales on tail imbricate, but lie flat against tail. Presacral vertebrae 26. Pattern and color undergo an ontogenetic change

—juveniles have light brown groundcolor and pattern of white cross-bands on neck and trunk; adults have a uniform brown color or darker brown speckling or vermiculations on trunk and head.

HOLOTYPE. MCZ 12084, a juvenile collected by D. W. Griswold on the island of Antigua in 1917.

DESCRIPTION OF THE SPECIES. Dorsal scales large, acute, strongly keeled, and imbricate; 24 to 31 axilla to groin, mean 27.5. Dorsal scales with knoblike scale organs and hair-bearing scale organs, each with 2 hairs. Middorsal area of granular scales present, 1 to 3 rows wide. Ventrals smooth and round, 25 to 32 axilla to groin, mean 27.9. Gulars keeled on sides of throat, in a few individuals keeled gulars extend across throat in a narrow band. Number of scale rows around midbody 41 to 49, mean 45.2. Internasals 1 to 3, mode 2. Upper labials 2 to 3, mode 3. Lamellae of fourth toe 7 to 10, mode 10. Escutcheon of male 22 to 25 scales wide, 3 to 6 scales long. Dorsal scales on tail keeled and slightly imbricate, but lie flat against tail. Midventral row transversely expanded into plates. Presacral vertebrae 26. Snout-vent length of smallest juvenile 13 mm.; adults 18 to 29 mm., mean 25.1.

The color pattern shows no sexual dichromatism, but it undergoes a marked ontogenetic change from juvenile to adult (fig. 7). The juvenile has a light brown dorsal groundcolor. The pattern consists

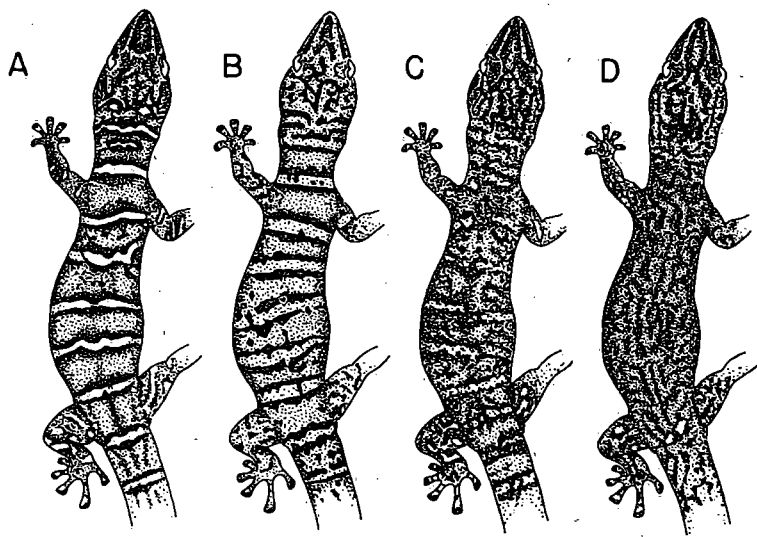


FIGURE 7. Variation in the markings of *Sphaerodactylus elegantulus*. (A) UF 10047.8; (B) MCZ 55610; (C) UF 10049.5; (D) UF 10051.3. A is a juvenile, the others are adult.

of dark brown-edged white crossbands on the neck, trunk, and tail. There are 4 to 6 of these crossbands between the axilla and groin, mode 5—UF 10047.8 (fig. 7 A) has 5 on the left side and 6 on the right; MCZ 55598 has 6 on the left and 5 on the right; MCZ 55613 has 4 on the left and 6 on the right. The chin and venter of the juvenile is white. As the lizard grows older the dorsal crossbands fade until they are indistinguishable from the groundcolor. The age at which the crossband pattern is lost seems to vary with the individual—some juveniles 13 to 14 mm. in snout-vent length are uniform brown (MCZ 15544, 15547, and 55599), and several adults of 23 to 24 mm. snout-vent length still retain the crossbands (UF 10049.5; MCZ 13487 and 55610). Nor does loss of the crossbanding seem correlated with sex. The dorsal color of the adult varies from light to dark brown with a white to light brown chin and venter. The dorsum may be uniform in color or may be speckled with dark scales. In some individuals these dark scales are numerous and form vermiculations, especially on the head. The occipital spot may be dark brown or may be light brown with a dark edge.

RANGE. The islands of Antigua and Barbuda. (For comment on its reported occurrence on St. Lucia, see under *S. vincenti festus*).

REMARKS. A large series collected on Barbuda during June and July includes a number of gravid females, each with one mature egg in its oviduct. Eggs occurred with this series of individuals in the moist debris under palm fronds and rocks in Darby Cave, a large sinkhole. The eggs measured 7.0 mm. by 5.5 mm.

Boulenger (1885:224) lists *S. fantasticus* from Antigua. He describes *fantasticus* as a sphaerodactyl that is light brown above and has a medium brown head vermiculated with white lines. This description, which fits *elegantulus* better than *fantasticus*, is probably based on the former.

The crossbanded juvenile of *elegantulus* has been confused with the crossbanded juvenile of *S. cinereus* of Cuba and Hispaniola. Two species from Barbuda in the U. S. National Museum (USNM 137828-137829, an adult and a juvenile), are catalogued as *S. elegans* (a synonym of *S. cinereus* based on its crossbanded juvenile).

S. elegantulus appears to be closely related to *S. fantasticus* and *S. sabanus*, but is easily distinguished by its color pattern.

MATERIAL EXAMINED. Antigua: MCZ 12084 (holotype), 13487-13492, 13494-13495, 15538-15539, 15541, 15543-15544, 28741, 55594-55613; AMNH 24708; PWH 591, 594 (5), 595 (5); UMMZ 76096 (7); USNM 61067. Barbuda: MCZ 15546-15547, 57770-57774; PWH 600

(7), 603 (15); UF 10046 (9), 10047 (8), 10048 (4), 10049 (9), 10050 (9), 10051 (9), 10052 (5); USNM 137828-137829.

Sphaerodactylus fantasticus Duméril and Bibron

Sphaerodactylus fantasticus Duméril and Bibron, 1836:406; Duméril, 1855:469.

Sphaerodactylus fantasticus Barbour, 1915:72, 1921:262.

Sphaerodactylus sputator Andersson, 1900:28.

Barbour (1915:73) points out that the type locality of this species was originally listed as Martinique (Duméril and Bibron, 1836:407). The syntypes were collected by Mr. Plée, notorious for the many incorrect localities on his "Martinique" specimens. Stejneger (1904: 622) states that Plée's trip through the Antilles began in Puerto Rico and ended in Martinique, from where he sent all his specimens to the Muséum National d'Histoire Naturelle, Paris. Apparently all of the specimens were assumed to have been collected on Martinique. Barbour (1915:73) compared Duméril and Bibron's description of *fantasticus* with a series of sphaerodactyls from Guadeloupe, and concluded that Guadeloupe was its correct type locality, not Martinique.

Recently, however, three sphaerodactyls—closely related to Barbour's *fantasticus*—were collected on Monserrat. The specimens fit Duméril and Bibron's description almost as easily as the Guadeloupe specimens do, yet scutellation differences exist between the Montserrat and Guadeloupe populations. Examinations of the syntypes of *Sphaerodactylus fantasticus* Duméril and Bibron (MNHN 1772) shows that the number of dorsal scales from axilla to groin—29 in all of the syntypes—is included within the variation of the Guadeloupe population (23-29), and not within the variation of the Montserrat population (35-38). The number of scale rows around midbody is 45 to 49 in the syntypes—also within the range of variation in the Guadeloupe (41-50), but not the Montserrat (52-54), population. Differences also exist in color pattern between the two populations, but these are slight.

In addition to these two islands, *S. fantasticus* has been collected on Désirade. In color Désirade specimens are identical to ones from Guadeloupe. In scutellation the two are similar save for one character—the number of dorsal scales from axilla to groin is 30 to 32 in the Désirade specimens. A larger series of specimens will probably produce a range of variation in this character overlapping that of the Guadeloupe population.

On the basis of the observed variation in color and scutellation

between the three populations—Désirade, Guadeloupe, and Montserrat—Barbour's belief that the syntypes of *Sphaerodactylus fantasticus* Duméril and Bibron were collected on Guadeloupe seems justified.

DIAGNOSIS. A sphaerodactyl with large, keeled, acute to round and slightly imbricate dorsal scales, and middorsal area of granular scales. Dorsal scales with both knoblike and hair-bearing scale organs. Ventrals keeled or smooth, and acute to round. Gulars keeled. Internasals 1 to 3, upper labials 3. Dorsal scales on tail imbricate, but lie flat against tail. Presacral vertebrae 26. Groundcolor brown, medium to light. Pattern sexually dichromatic—males with uniform brown heads, or light brown heads with dark brown speckling or dark brown post-orbital stripes; females with light to medium brown heads with dark brown postorbital stripes extending caudad from eyes along neck and fading on trunk.

KEY TO THE SUBSPECIES.

Ventral scales keeled or smooth; 23-34 dorsal scales from axilla to groin; 41-50 scale rows around midbody; Guadeloupe, Désirade _____

_____ *Sphaerodactylus f. fantasticus*

Ventral scales smooth; 35-38 dorsal scales from axilla to groin; 52-54 scale rows around midbody; Montserrat. *Sphaerodactylus f. ligniservulus*, new subspecies

Sphaerodactylus fantasticus fantasticus Duméril and Bibron

Sphaerodactylus fantasticus Duméril and Bibron, 1836:406; Duméril, 1855:469.
Sphaerodactylus fantasticus Barbour, 1915:72, 1921:262.
Sphaerodactylus sputator Andersson, 1900:28.

SYNTYPES. Three adult males, MNHN 1772, collected by M. Plée on the island of "Martinique" (= Guadeloupe), (fig. 8 E).

DESCRIPTION OF THE SPECIES. Dorsal scales large, keeled, acute to round, and slightly imbricate; 23 to 34 axilla to groin, mean 25.7. Dorsal scales with knoblike scale organs and hair-bearing scale organs, each with one hair. Area of middorsal granular scales present; 2 to 4 rows wide. Ventrals lightly keeled or smooth (keeled dorsal scales extend down onto lateral edges of venter, and in some individuals continue across stomach), and acute to round; 27 to 32 axilla to groin, mean 29.3. Gulars strongly keeled, and extend caudad onto chest in all specimens. Scale rows around midbody 41 to 50, mean 44.3. Internasals 1 to 3, mode 2. Upper labials 3. Lamellae of fourth toe 8 to 12, mode 9 or 10. Escutcheon of male 23 to 29 scales wide, and 3 to 5 scales long. Dorsal scales of tail keeled, acute, and imbricate, but lie flat against tail. Midventral row transversely expanded into plates.

Presacral vertebrae 26. Snout-vent length of smallest juvenile is 13 mm.; adults 22 to 29 mm., mean 26.1.

The pattern is sexually dichromatic. Both sexes have a brown dorsal groundcolor. The female has a dark brown stripe from the nostril to the eye, which continues as a postorbital dark stripe onto the neck and converges slightly in the scapular region with one from the opposite side. In some individuals a dark stripe, beginning as a subpost-orbital stripe, parallels the postorbital stripe on the neck and in the scapular region, and is separated from it by a light strip of ground-color. Both fade into the groundcolor on the trunk. A dark stripe extends from the snout to a point between the eyes where it divides into two, each branch continuing to a point immediately behind the orbit. They then continue caudad and toward the midline, where

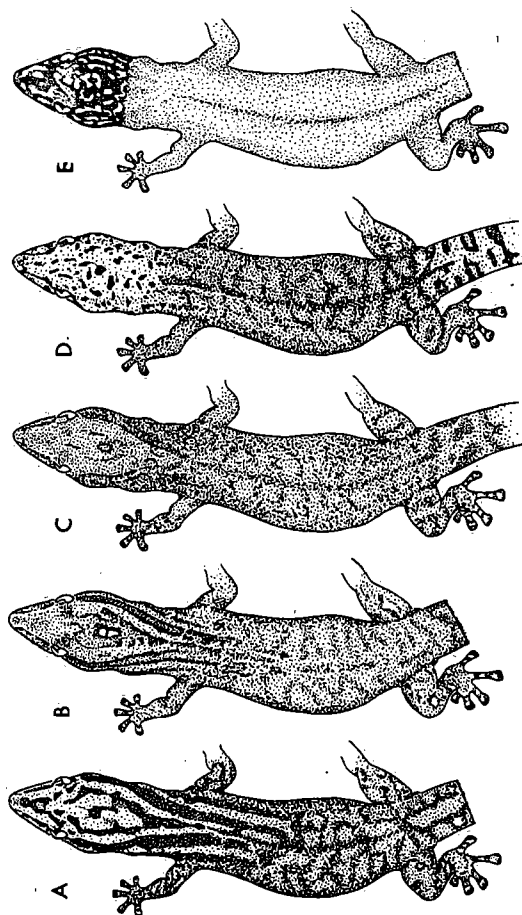


FIGURE 8. Variation in the markings of adult *Sphaerodactylus fantasticus* *fantasticus*. (A) MCZ 10649; (B) MCZ 10652; (C) MCZ 10631; (D) 10636; (E) MNHN 1772 (one of three syntypes). A and B are females; C, D, and E are males.

anterior to the scapular region they unite to form a dark vertebral stripe, exactly the width of the area of middorsal granules, that continues to the base of the tail. The occipital spot is white to light brown and has a dark brown outline, and may be connected by dark lines to the head stripes. In some individuals this complex of markings is obscure or ill-defined (fig. 8 B), in others sharp and distinct (fig. 8 A). Males have a light brown head which may lack all markings, or have only a hint of the female pattern (fig. 8 C). Other males have the dark stripes broken into small dark brown spots scattered evenly over the sides and upper surface (fig. 8 D). In still others the dark brown spots coalesce to produce a dark head with light stripes or spots (fig. 8 E). Trunk markings of both sexes are the same. Both have the dark vertebral stripe and a scattering of dark scales which form rough crossbands or vermiculations. The groundcolor of the tail becomes lighter than the body color at its base, changing to a dull white or light brown toward its tip. Dark scales on the tail form broken longitudinal lines, crossbands, or spots, or may enclose a few white scales to form ocelli. The chin and throat are uniform white or may have a series of dark brown scales arranged in longitudinal rows. The juvenile pattern is similar to that of the adult female except that the pattern is usually sharp and clear.

RANGE. The islands of Guadeloupe and Désirade, and probably Iles des Saintes and Marie Galante.

REMARKS. Duméril and Bibron (1836:406) described *S. fantasticus*, on the basis of the three types (MNHN 1772), as having a black head with white vermiculations. They also (1836:407) described a variety of *fantasticus* that was identical in scutellation, but differed in the coloration of the head. These three specimens (MNHN 1770) have longitudinal stripes on their heads. One of the syntypes of the species was figured in that publication (plate 32, fig. 2). Later Duméril (1855:469) redescribed and figured (plate 17, fig. 3) both forms. Examination of the three syntypes of *S. fantasticus* (MNHN 1772) reveals that they are all males (with dark heads). The three syntypes of the variety (MNHN 1770) are two females (with longitudinally striped heads) and a single male (with a uniform brown head). Duméril and Bibron's variety of *S. fantasticus* is based on the sexually dichromatic pattern of the species.

A roentgenogram reveals that this species (USNM 103984) ingests snails as part of its diet. The soft parts of these animals are digested and the shells probably passed in the fecal material.

Barbour (1921:263) reports that Noble collected single oblong eggs

of this species in rotten wood. The eggs measured 6.5 mm. by 4.75 mm. The series of individuals that Noble collected during the summer of 1914 contains a number of gravid females. Each contains one mature, shelled egg.

MATERIAL EXAMINED. Guadeloupe: MNHN 1772 (3) syntypes, 1770 (3); AMNH 24714; MCZ 10631-10632, 10634-10680 (81); RMNH 2681 (2), 2683 (2); USNM 103984. Désirade: MCZ 66419-66420.

Sphaerodactylus fantasticus ligniservulus, new subspecies.

HOLOTYPE. MCZ 66968, an adult male collected by Père Pinchon, at Plymouth, Montserrat (fig. 9 C).

DESCRIPTION OF HOLOTYPE (AND OF SUBSPECIES). Dorsal scales keeled, acute to round, and slightly imbricate; 38 axilla to groin (35 to 38, mean 37.0). Dorsal scales with knoblike and hair-bearing scale organs, each with 1 to 2 hairs. Area of middorsal granular scales present, 3 rows wide. Ventrals smooth, and acute to round; 34 axilla to groin (32 to 34, mean 32.6). Gulars keeled across throat. Scale rows around midbody 54 (52 to 55, mean 53.6). Internasals 2 (1 to 2, mode 2). Upper labials 3. Lamellae of the fourth toe 10 (10 to 11, mode 11). Escutcheon 28 scales wide (27 to 28), and 6 scales long. Dorsal scales of tail keeled, acute, and imbricate, but lie flat against tail. Midventral row transversely expanded into plates. Presacral vertebrae 26. Snout-vent length 21.5 mm. (21.5 to 22.5 mm., mean 22.0).

The pattern is sexually dichromatic. Both sexes have a light brown dorsal groundcolor. The holotype, a male, has an obscure medium brown stripe from the nostril to the eye. It continues caudad from the eye as a postorbital dark stripe and extends onto the neck where it swings toward the midline to become a paravertebral stripe. It continues onto the trunk where it fades into the groundcolor. A faint dark stripe extends from the tip of the snout to a point between the eyes where it divides into two. Each branch continues caudad, swings slightly laterad to encircle an occipital spot, and returns to the midline where it fuses with the one from the opposite side. It immediately fades into the groundcolor in the scapular region. The occipital spot is a light gray-brown triangle with dark edges. The trunk is a uniform light brown. The area of middorsal granular scales is slightly darker than the surrounding scales. The tail is light brown, with scattered white scales arranged in irregular transverse series. The chin, throat, and venter are white.

The pattern of the female is like that of the male, but much more vivid. The stripe from the nostril to the eye is dark brown. The post-

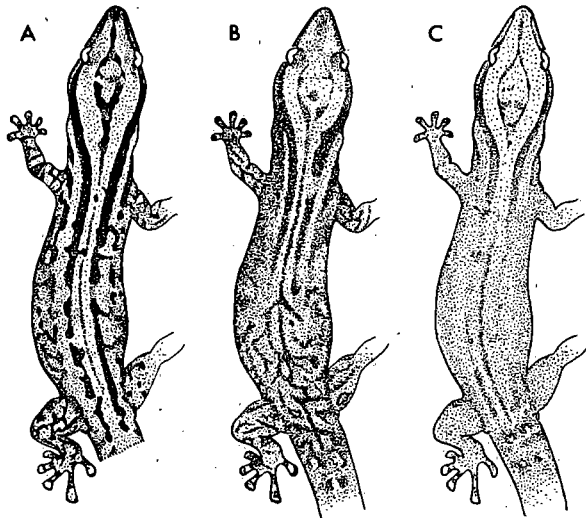


FIGURE 9. Variation in the markings of adult *Sphaerodactylus fantasticalus ligniservulus*. (A) MCZ 66969; (B) MCZ 66967; (C) MCZ 66968. A is a female, B and C, males. C is the holotype.

orbital stripe is dark brown to black, and is bordered above and below by a light brown to white stripe of equal width. It continues as a paravertebral stripe along the trunk and onto the base of the tail. The stripe from the tip of the snout, which divides and encircles the occipital spot, is dark brown. It continues onto the trunk as a vertebral dark stripe exactly the width of the middorsal area of granular scales. The occipital spot is white with dark brown to black edges. The chin and throat are white with dark brown to black bars and vermiculations. The venter is white, the edge of each scale sparsely stippled with black.

These variations in pattern are illustrated in figure 9.

RANGE. The island of Montserrat.

REMARKS. *S. f. ligniservulus* appears to be almost intermediate between *S. f. fantasticalus* of Guadeloupe and *S. sabanus* of nearby Nevis, St. Kitts, Statia, and Saba. The color patterns of all three are similar, and it is easy to imagine how the *sabanus* pattern could be derived from the *fantasticalus* pattern. *S. f. fantasticalus* has large dorsal scales (23-24 axilla to groin) and *S. sabanus* has smaller ones (33-42). *S. f. ligniservulus* is intermediate (35-38). It is also intermediate in the other scutellation differences that exist between *S. f. fantasticalus* and *S. sabanus*. However, no *fantasticalus* possesses as many presacral vertebrae as *S. sabanus*.

The dark-headed males, seen in both *S. f. fantasticus* (fig. 8 E) and *S. sabanus* (fig. 4 C), have not yet been observed in *ligniservulus*.

MATERIAL EXAMINED. Montserrat: MCZ 66968 (holotype), 66967, 66969 (paratypes).

Sphaerodactylus microlepis Reinhardt and Lütken

Sphaerodactylus microlepis Reinhardt and Lütken, 1862:278; Barbour, 1921:267.

DIAGNOSIS. A large sphaerodactyl with medium-sized, keeled, acute, and slightly imbricate dorsal scales, and a middorsal area of smaller keeled scales (no well-defined area of granules). Dorsal scales have hair-bearing scale organs on their dorsodistal edge. Ventrals strongly keeled and acute. Gulars strongly keeled. Internasals 2 to 4; upper labials 3. Dorsal scales of tail imbricate, and stand erect from tail. Presacral vertebrae 26. Color and pattern of dorsum light brown, which may have dark brown crossbands. Venter white. Head with straw brown groundcolor. Dark brown postorbital stripes form a V on neck. Dark brown or black collar often present. Chin and throat with dark brown and white longitudinal stripes.

HOLOTYPE. A specimen (museum number unknown) in the Kobenhavns Universitet, Zoologisk Museum, Copenhagen, collected by Mr. Knudsen on the island of St. Lucia.

DESCRIPTION OF THE SPECIES. Dorsal scales keeled, acute, and slightly imbricate; 42 to 53 axilla to groin, mean 47.4. Dorsal scales with hair-bearing scale organs, bearing one hair each, on dorsodistal edge. No well-defined middorsal area of granules, but middorsal scales reduced in size. Ventrals strongly keeled (more strongly than dorsals), and acute; 32 to 40 axilla to groin, mean 34.5. Gulars strongly keeled. Number of midbody scale rows 62 to 74, mean 63.7. Internasals 2 to 4, mode 3. Upper labials 3. Lamellae of fourth toe 9 to 12, mode 10 and 11. Escutcheon of male 22 to 31 scales wide, and 7 to 10 scales long. Dorsal scales on tail keeled, acute, and imbricate—almost conical (triangular in cross-section)—and stand erect giving a fuzzy appearance to tail. Midventral row acute, keeled, and not transversely expanded. Presacral vertebrae 26 (one specimen in series UMMZ 71990 has 25). Snout-vent length of smallest juvenile 24 mm.; adults 28 to 33 mm., mean 31.2.

The color pattern of adults shows a wide range of variation. No sexual dichromatism is evident, but there seems to be a slight ontogenetic change from juvenile to adult. The juveniles and some adults have a light brown dorsal groundcolor with a series of 6 to 7 dark brown crossbands between the axilla and groin. In some adults these

crossbands break up or fade until they are indistinguishable from the groundcolor. On the neck just anterior to the shoulders is a brown or black collar with a white or light brown posterior border. A black to dark brown postorbital stripe extends caudad and toward the midline, and joins the one from the opposite side on the neck. These stripes are faded or absent in some specimens (fig. 10 D) and in some they may fail to join. They are frequently connected to the dark collar band (fig. 10 A and C). On each side of the midline on the neck, in the angle formed by the postorbital stripes and the dark collar, is a white spot (fig. 10 A and C). Some individuals with a faded collar and postorbital stripes show a trace of these spots. The

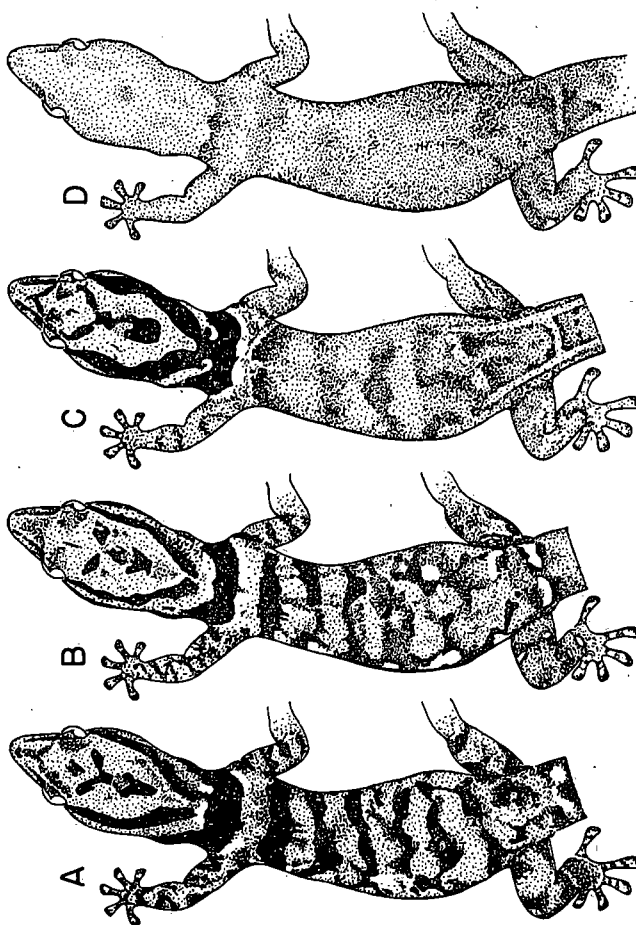


FIGURE 10. Variation in the markings of adult *Sphaerodactylus microlepis*. (A) MCZ 32563; (B) MCZ 32573; (C) MCZ 32572; (D) MCZ 32564.

occipital spot is white to gray and usually connected to a dark brown or black postoccipital spot. Dark parietal spots are present and may be connected to the occipital spot forming a triangular marking. A light brown ladder-shaped marking is present on the tail and sacral region. In some specimens with a broken tail this has the appearance of an H as the posterior part of the "ladder" is missing (fig. 10 C). The chin is boldly marked with dark brown or black stripes on a white groundcolor. Stripes extend caudad from the chin to the throat and chest. In some individuals these markings are faded or absent. The venter is white.

RANGE. The islands of St. Lucia and Dominica, and probably Martinique.

REMARKS. One female (MCZ 325663) has a single mature egg in her oviduct.

Reinhardt and Lütken (1862:278) list the type locality of the species as St. Croix. Barbour (1921:268) points out that the type locality is given in error because of an incorrect label.

Boulenger (1891:351) lists a single male specimen of this species collected on Dominica prior to 1891. Although Barbour (1921:268) thinks that this specimen does not represent *microlepis*, there can be little doubt concerning the correctness of the identification. Boulenger states:

All the scales on the . . . body . . . very strongly keeled . . . small on the middle of the back . . . 62 scales round the middle of the body. Tail cylindrical, tapering; upper caudal scales pointed and raised, giving the organ a roughish appearance . . . no subcaudal enlarged shields. Dark brown above, with some lighter dots; pale brown beneath.

This combination of characters—keeled ventrals, dorsal scales on the tail raised, giving a rough appearance, and no enlarged subcaudal shields—is not found in any other Lesser Antillean sphaerodactyl. Boulenger also cites a head and body (= ? snout-vent) length of 37 mm., indicating a large sphaerodactyl such as *microlepis*.

Martinique lies between the islands of St. Lucia and Dominica; future collecting may reveal this species on that island.

The relationships of *S. microlepis* are not clear, although it seems to be distantly related to *S. vincenti* and *S. caicosensis*.

MATERIAL EXAMINED. St. Lucia: MCZ 10787, 32561-32575 (15), 32576; UF 10129 (2); UMMZ 71990 (10); USNM 120720-120721.

Sphaerodactylus vincenti Boulenger

Sphaerodactylus vincenti Boulenger, 1891:354.

Barbour (1915:73) gives no characters for separating *S. festus* from *S. vincenti* in his original description of *festus*. Later (1921:225) he separates *festus* from *vincenti* on the basis of the middorsal area of smaller scales which *vincenti* possesses and *festus* lacks. His illustration of the dorsal scales in that publication (plate 15, fig. 4) clearly shows that the dorsal scales of *festus* are smaller in the middorsal region than in the lateral region. Examination of specimens of both forms reveals no significant or constant difference in the degree to which the middorsal area is differentiated. A difference does exist, however in the size of the dorsal scales—*vincenti* has smaller, more numerous scales than *festus*. This is shown in the number of scale rows around midbody (60-63 in *vincenti*; 53-62 in *festus*), and in the number of dorsal scales between axilla and groin (47-53 in *vincenti*, 36-49 in *festus*). Overlap in these characters is evident. Only minor differences are present in their color patterns (figs. 11 and 12). In view of the overlap in morphological and color-pattern characters, and since the geographic ranges are continuous, I consider the two conspecific.

DIAGNOSIS. A *sphaerodactyl* with small, keeled, granular scales, and middorsal area of smaller scales, but no well-defined area of granules. Dorsal scales with both knoblike and hair-bearing scale organs. Ventrals smooth and round. Gulars keeled. Internasals 0 to 2, upper labials 3. Dorsal scales of tail imbricate, but lie flat against tail. Presacral vertebrae 26. Groundcolor brown. Dorsal pattern primarily a white or light brown V in sacral region. Suprapostorbital light stripe extends from eye caudad toward midline fusing with one from opposite side on neck and forms a light V on head and neck. Dorsolateral black-edged white ocelli present in scapular region of juveniles and most adults.

KEY TO THE SUBSPECIES.

- Dorsal scales 36-49 axilla to groin; scale rows around midbody 53-62; Martinique, Dominica, and St. Lucia *Sphaerodactylus v. festus*.
Dorsal scales 47-53 axilla to groin; scale rows around midbody 60-63; St. Vincent *Sphaerodactylus v. vincenti*

Sphaerodactylus vincenti festus Barbour

Sphaerodactylus festus Barbour, 1915:13; Barbour, 1921:242.

Sphaerodactylus monilifer Barbour, 1921:271.

HOLOTYPE. MCZ 10622, an adult female collected by A. G. Ruthven on the island of Martinique on 4 July 1914 (fig. 11 D).

DESCRIPTION OF THE SUBSPECIES. Dorsal scales small, keeled, granular; 36 to 42 axilla to groin, mean 41.3. Dorsal scales with knoblike scale organs and hair-bearing scale organs, with 1 to 2 hairs each. No well-defined middorsal area of granules, but middorsal scales reduced in size. Ventrals smooth and rounded; 28 to 31 axilla to groin, mean 30.1. Gulars keeled, broad band extends across throat and anterior chest. Scale rows around midbody 53 to 63, mean 58.4. Internasals 1 to 2. Upper labials 3. Lamellae of fourth toe 9 to 12, mode 9. Escutcheon of male 26 to 30 scales wide, and 7 to 10 scales long. Dorsal scales of tail keeled, acute, and imbricate, but lie flat against the tail. Midventral row transversely expanded into plates. Presacral vertebrae 26. Snout-vent length of smallest juvenile 18 mm.; adults 23 to 29 mm., mean 25.0.

The color pattern shows no sexual dichromatism, and seems to undergo no marked ontogenetic change. The dorsal groundcolor is a light to medium brown. The dorsal pattern is of a few scattered dark brown scales. There may also be a few white spots or ocelli with dark brown edges (fig. 11 D), prominent in a dorsolateral scapular position and edged with dark brown or black. In some individuals the dark-edged spots extend across the back to fuse with the ones on the opposite side (fig. 11 A), and in others are obscure (fig. 11 D) or absent. The spots are fused in the pelvic region forming a prominent V-shaped marking with dark edges (fig. 11). On the tail the dark-edged white markings occur as dorsolateral spots, or are joined in the midline to form white crossbars. The head has a light to medium brown groundcolor. A line of slightly darker color extends from the nostril to the eye. A suprapostorbital white stripe with dark brown edges extends caudad and toward the midline on the neck, fusing with the one from the opposite side just anterior to the scapular region. In some individuals these stripes are obscure and do not fuse in the scapular region. The occipital spot is white to light brown with dark edges. Chin and throat are uniform light brown, or may have brown bars or vermiculations. The venter is a uniform light to medium brown.

RANGE. The islands of Martinique, Dominica, and probably St. Lucia.

REMARKS. Parker (1933:152) states that *S. elegantulus* occurs on St. Lucia. This report is based on one specimen in the British Museum (Natural History), London. He states:

... comparison with six specimens from Antigua reveals only trivial differences.

There can be little doubt of the correctness of the locality, for the specimen was collected in 1931, in which year no reptiles were obtained on Antigua. . . . The only possible conclusions appear to be either that *elegantulus* has been introduced into Sta. Lucia or that this island harbours two species, *S. microlepis* and one very similar to *S. elegantulus*.

No individuals of *S. elegantulus* have been reported from St. Lucia since that time. Parker points out that the specimen is not *S. microlepis*, and that the locality can not be doubted. It seems reasonable that the specimen may be *S. vincenti*, with which Parker failed to compare his specimen. This is suggested by the fact that immediately south of St. Lucia lies St. Vincent with *S. v. vincenti*, and to the north are Martinique and Dominica with *S. v. festus*. Specimens of both *S. elegantulus* and *S. v. festus* are occasionally uniformly brown in color and superficially similar.

Günther (1888:363) lists three specimens of *Sphaerodactylus copii* (= *Sphaerodactylus copei*), a Haitian species, from Dominica. The specimens were collected by a Mr. Ramage from the vicinity of Laion (= ? Layou). Günther states that these specimens agree in "technical characters" (= ? scutellation) with *S. copei*. Steindachner (1867:18) in his description of *S. copei*, described the middorsal area of small granular scales. Günther, unfamiliar with this character in *Sphaerodactylus*, apparently applied the name to the specimens from Do-

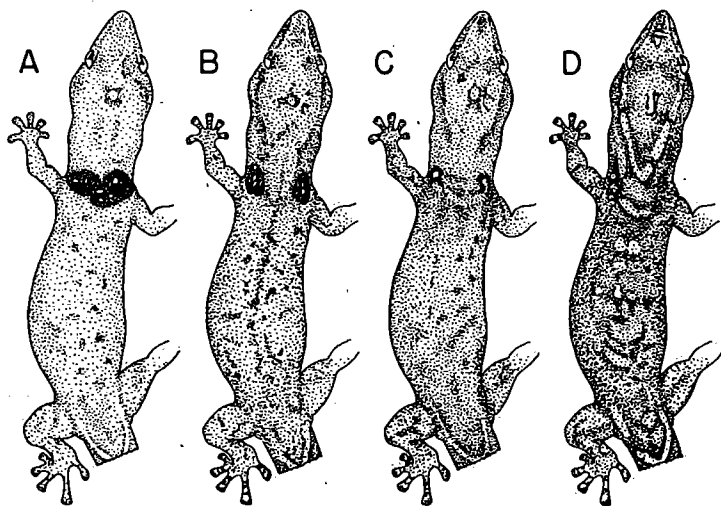


FIGURE 11. Variation in the markings of adult *Sphaerodactylus vincenti festus*. (A) USNM 121223; (B) MCZ 10786; (C) MCZ 10623; (D) MCZ 10622. D is the holotype of *S. festus*; B is the holotype of the synonym, *S. monilifer*.

minica when he discovered they had small scales in the middorsal area. One of these specimens later found its way to the Museum of Comparative Zoology, where Barbour (1921:271) described it as *Sphaerodactylus monilifer*. In his key to the species of *Sphaerodactylus*, Barbour (1921:225) separates *monilifer* from *festus* on the basis of the middorsal scales—*festus* has no differentiated middorsal zone of granules or smaller scales, and *monilifer* has a middorsal zone of scales reduced in size, but not granular. He also states that *festus* has 14 to 15 dorsal scales in the distance from the tip of the snout to the center of the eye, *monilifer* 10 to 11. In the plates that accompany those descriptions, the number of dorsal scales contained in this "standard distance" (*festus*, plate 15, fig. 4; *monilifer*, plate 26, fig. 8) is shown for both species to be 10 to 11. The plates also clearly show that *festus*, as well as *monilifer*, has reduced, although not granular, middorsal scales. In his description of *monilifer* (1921:272) Barbour lists the color as a uniform brown with a prominent ocellus on each side of the scapular region, and states:

This species is allied to . . . *vincenti* but has a much less differentiated area of dorsal scales and much larger scales throughout. I have only seen one specimen but of this the coloration is uniquely different from any *Sphaerodactylus* I have ever observed.

Had Barbour examined the type of *S. festus* (MCZ 10622, fig. 11 D) closely he would have found an obscure ocellus on the left side in the scapular region. The paratype of *S. festus* (MCZ 10623, fig. 11 C) has a small but easily seen ocellus on each side. One specimen (USNM 121223, fig. 11 A) collected on Martinique, has a scapular ocellus which is fused across the back with the one from the opposite side. As no character of scutellation or pattern has yet been found that will separate *monilifer* from *festus*, *Sphaerodactylus monilifer* Barbour is considered a synonym of *Sphaerodactylus vincenti festus* Barbour. It must be pointed out, however, that only the one specimen of *monilifer* has been seen. Future collecting may prove this population to be distinct as Barbour believed it to be.

MATERIAL EXAMINED. Martinique: MCZ 10622 (holotype), 10623; AMNH 6576; RMNH 10430 (2); USNM 79061, 121223, 121648. Dominica: MCZ 10786.

Sphaerodactylus vincenti vincenti Boulenger

Sphaerodactylus vincenti Boulenger, 1891:354; Barbour, 1921:270.

HOLOTYPE. Syntypes consist of a specimen in the British Museum (Natural History), London, and MCZ 10788, the latter an adult female collected by H. H. Smith on St. Vincent Island prior to 1891 (fig. 12 C).

DESCRIPTION OF THE SUBSPECIES. Dorsal scales small, keeled, and granular; 47 to 53 axilla to groin, mean 49.5. Dorsal scales with knob-like scale organs and hair-bearing scale organs, with 1 to 2 hairs each. No well-defined middorsal area of granules, but middorsal scales reduced in size. Ventrals smooth and rounded; 27 to 35 axilla to groin, mean 32.1. Gulars keeled, broad band extends across throat, but not caudad onto chest. Scale rows around midbody 60 to 63, mean 61.6. Internasals 0 to 1. Upper labials 3. Lamellae of fourth toe 9 to 10, mode 10. Escutcheon of male 24 scales wide, 4 scales long. Dorsal scales of tail keeled, acute, and imbricate, but lie flat against tail. Midventral row transversely expanded into plates. Presacral vertebrae 26. Snout-vent length of smallest juvenile 15 mm.; adults 20-27 mm., mean 23.5.

The color pattern shows no sexual dichromatism, and undergoes no striking ontogenetic change. The juvenile pattern is, however, slightly more vivid than that of the adult. The juvenile has a light to medium brown dorsal groundcolor. The dorsal pattern consists of a few scattered dark brown scales, and in a few specimens dorso-

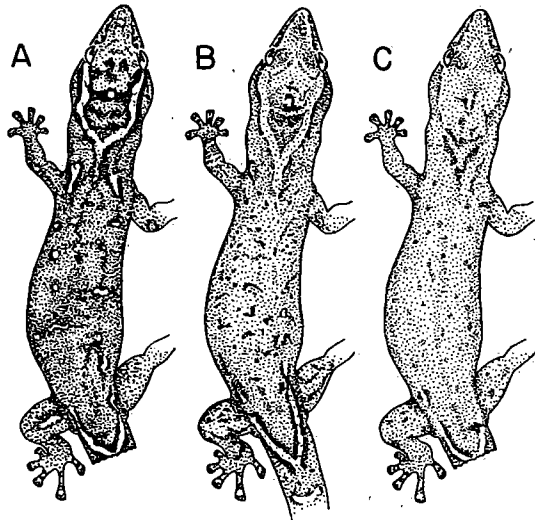


FIGURE 12. Variation in the markings of adult *Sphaerodactylus vincenti vincenti*. (A) MCZ 20550; (B) MCZ 38193; (C) MCZ 10788. C is a syntype of *S. vincenti*.

lateral white spots with dark brown edges. These spots tend to be larger in the scapular region forming ocelli (fig. 12 A). In the pelvic region the spots fuse to form a prominent white, V-shaped mark. On the tail the white markings continue as dorsolateral spots, or fuse across the midline to form white crossbars (fig. 12 B). The crossbars are joined in some specimens by a narrow middorsal stripe forming a series of connected Y's. The head has a light to medium brown groundcolor. A slightly darker line runs from the nostril to the eye. A suprapostorbital white stripe, with dark brown edges, extends caudad and toward the midline, fusing with the one from the opposite side just anterior to the scapular region. It then continues as a single middorsal white stripe and fades into the groundcolor over the shoulders. The occipital spot is usually white, edged with dark brown, but in a few individuals it is a simple dark brown spot. The chin and throat are uniform light brown or may have longitudinal brown bars or vermiculations. The venter is uniform light brown. The adult pattern is similar to the juvenile, except that it is less well defined. The dorsolateral white spots on the body are faded or absent. White spots in the scapular area are faded, as are the head markings. The only part of the pattern that remains bright and well defined is the white V in the pelvic region (fig. 12).

RANGE. The island of St. Vincent.

REMARKS. Boulenger (1891:354) lists the color of (living) specimens as:

Brown above, head lighter; a pale, dark-edged V-shaped marking may be present at the base of the tail; lower parts pale brown, the scales edged with darker; tail coral-red, all over or only on the lower surface.

He also states that the specimens were found under rotting leaves in damp forest.

MATERIAL EXAMINED. St. Vincent: MCZ 10788 (syntype), 20550, 38190-38194 (6).

Sphaerodactylus molei Boettger

Sphaerodactylus molei Boettger, 1894:80; Barbour, 1921:237; Shreve, 1947:522.

Sphaerodactylus buergeri Werner, 1900:264; Barbour, 1921:248.

Sphaerodactylus venezuelanus Roux, 1927:254.

DIAGNOSIS. A small sphaerodactyl with small, keeled, granular scales, and a middorsal area of smaller, keeled scales; no well-defined area of granules. Dorsal scales with hair-bearing scale organs. Ventrals smooth and round. Gulars smooth. Internasals 1 to 3; upper labials 4. Dorsal

scales on tail slightly imbricate, but lie flat against tail. Presacral vertebrae 26. Color pattern consists of longitudinal white stripes on groundcolor of light brown. White stripes dorsolateral in position and usually edged with dark brown.

HOLOTYPE. A specimen (museum number unknown) in the Natur-Museum Senckenberg, Frankfort-am-Main, collected by R. R. Mole at Caparo, Trinidad prior to 1894.

DESCRIPTION OF THE SPECIES. Dorsal scales juxtaposed, small, keeled, and granular; 64 to 74 axilla to groin, mean 67.9. Dorsal scales with hair-bearing scale organs, with four or more hairs each. No well-defined middorsal area of granules, but middorsal scales reduced in size. Ventrals smooth and round; 35 to 41 axilla to groin, mean 38.0. Gulars smooth. Scale rows around midbody 74 to 82, mean 77.2. Internasals 1 to 3, mode 2. Upper labials 4. Lamellae of fourth toe 8 to 12, mode 10. Escutcheon of male 5 to 7 scales wide, 4 to 6 scales long. Dorsal scales of tail keeled and imbricate, but lie flat against tail. Midventral row large, but not transversely expanded into plates. Presacral vertebrae 26. Snout-vent length of smallest juvenile 16 mm.; adults 20 to 27 mm., mean 23.4.

There is a slight indication of sexual dichromatism—the most vividly marked specimens are all males, although drab and uniform-colored specimens of both males and females occur. The dorsal groundcolor is light brown to dull white. There is a dark brown stripe extending from the nostril to the eye. It is bordered below by a white stripe which runs through the eye and continues dorsolaterally along the neck and trunk and onto the tail. These stripes may be ill defined in either sex and nearly the same as the groundcolor (fig. 13 D and E). On the tail the stripes may continue separately or may connect with each other across the midline forming a series of transverse bands (this can be seen in MCZ 48896, 48897, and 48898) similar to the bold crossbanding on the tail of *S. lineolatus*. On the neck and trunk the stripes usually have dark brown or black edges, but in either sex these may be ill defined, broken into a row of spots, faded, or absent (fig. 13). Vividly marked specimens (males) have a dark occipital spot which joins the dark edges of the white stripes on the head (fig. 13 A and B). The chin is white with a few scattered light brown specks. The venter is white to gray white.

RANGE. The islands of Trinidad and Tobago, and the mainland of British Guiana, and Venezuela.

REMARKS. Roentgenograms reveal that the stomach of MCZ 48896 contains small snail shells.

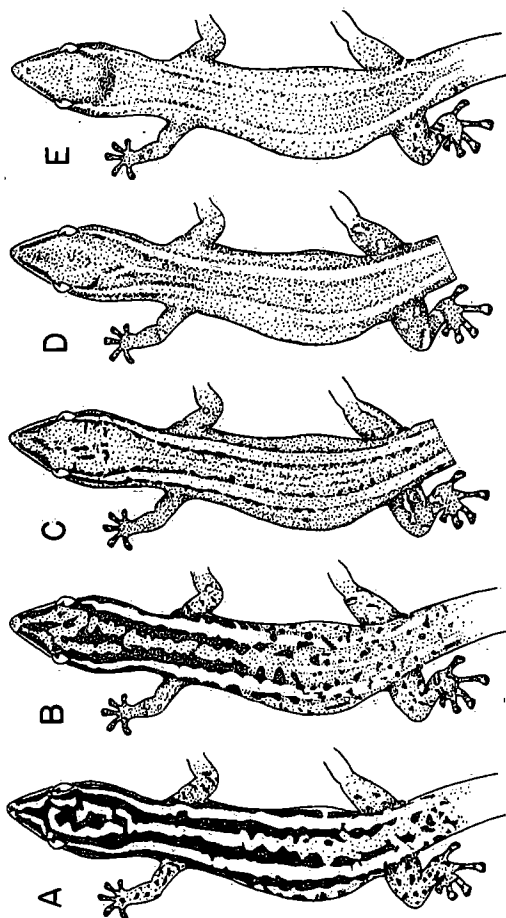


FIGURE 13. Variation in the markings of adult *Sphaerodactylus molei*. (A) MCZ 55713; (B) MCZ 55716; (C) MCZ 55717; (D) MCZ 12055; (E) MCZ 55714.

Beebe (1944:153) states that these lizards are found on houses and are active at night, running

... over the walls and up the legs of our tables. It creeps very slowly when stalking prey and at other times runs with short, quick darts. When frightened its short legs become inadequate, and progression is by a frantic sinuous wiggling, almost *Leposoma*-like.

He showed that eggs are laid during July and measure 5.0 to 5.5 mm. by 7.0 mm. Females usually lay one egg, but he collected one female with two fully formed eggs in her oviducts. One embryo, just prior to hatching, measured 33 mm. total length (approximately 16 mm. snout-vent length). Eggs were laid in a rotten stump. He observed *Thecadactylus* prey on this species.

Beebe (1944:154) gives the color of these lizards in life. The patterns are the same as listed above in the description of the species. The breeding male has a groundcolor on the head of white, on the body of drab green, and on the tail of a dull rust color. The lower surfaces of the head, chin, and throat are yellow green; the venter, white. Nonbreeding males have an orange groundcolor on the head, olive on the trunk, yellow orange on the tail. The chin is chrome yellow and the venter light yellow orange. The female has a gray head and neck and gray-brown trunk. The juvenile groundcolor is gray on the head and gray to olive on the trunk. Shreve (1947:523) lists the colors in life of this species as yellow brown to gray orange on the tail, and gray to light yellow on the throat, with dark spots.

Boulenger (1885:224) records a specimen of *S. fantasticus* from Caracas, Venezuela. This record is based either on erroneous locality data or on the misidentification of a specimen of *molei*.

S. molei is closely related to *S. lineolatus* of Central America. Future collecting in the vicinity of Colombia's Maracaibo basin may prove the two to be conspecific.

MATERIAL EXAMINED. Tobago: MCZ 55713-55717. Trinidad: AMNH 72891; MCZ 8993, 12054-12055. British Guiana: MCZ 14676. Venezuela: MCZ 48720-48721, 48895-48899.

DISPERSAL

Two means of faunal migration from the mainland to the West Indies have been suggested. Land-bridge connection with the mainland has been suggested by Barbour (1914, 1916), Scharff (1922), and Schuchert (1935); and waif dispersal by rafts and windstorms has been proposed by Darlington (1938, 1957), Myers (1938), Simpson (1956), and Williams and Koopman (1952). Geological evidence shows that several of the islands on the same bank, e.g., Anguilla, Dog Island, Ile Fourche, St. Barts, St. Martin, and Tintamarre; Antigua and Barbuda; Statia, St. Kitts, and Nevis; Grenada and the Grenadines, may have been connected during the lower sealevels of the Pleistocene. However, the Lesser Antilles have not been connected to the mainland, or to the Greater Antilles, at any time during their existence (Butterlin, 1957; Schuchert, 1935). Therefore the Lesser Antillean fauna could have reached the islands only by means of waif dispersal.

Darlington (1938) seems to favor windstorms as the means by which the West Indian fauna entered the islands. He states that palm fronds and similar vegetative debris can be picked up in a wind-

storm and carried from one place to another. He further states (1938: 284): "I have often collected in palm boots not only a variety of insects and ground mollusks and other invertebrates, but snakes and lizards and frogs." A quick review of the literature containing examples of windstorm dispersal of vertebrates reveals some interesting facts. McAtee (1917) lists "rains" of fish, newly metamorphosed frogs and toads, larval salamanders, an adult *Gopherus*, numerous birds, and one "rain" of rats (lemmings). Gudger (1921) lists 42 accounts of fish "rains." Questrel (1941:224) suggests that the hurricane of 1899 brought an agricultural pest, a thrush, to St. Barts. Note that these accounts, with the exception of the *Gopherus* and the lemmings, involve only aquatic animals that can be picked up easily in a waterspout, or aerial vertebrates that can be easily blown about by a storm. This is not to imply that terrestrial vertebrates cannot be transported in a windstorm, but that aquatic or aerial vertebrates are more apt to be carried than are the terrestrial forms. It is worth mentioning that the Antilles lie in the direct path of most of the hurricanes which form in this region (Tannehill, 1938:64), and that consequently strong cyclonic winds are available for transportation of waifs. The general direction taken by hurricanes in the Lesser Antilles is west-northwest, along the island chain.

The alternative to windstorm dispersal is rafting, and geckos, including *Sphaerodactylus*, have a number of adaptations that make them ideally suited for this type of dispersal. *Sphaerodactylus* is frequently collected under logs, coconut husks, palm fronds, driftwood, tidal wrack, and similar debris in the forests and on the beaches. These places frequently are the nesting sites of the lizards. Each female lays only one egg, but *Sphaerodactylus*, like many other geckos, lays its eggs in communal nests. Duellman and Schwartz (1958:276) found a communal nest of *S. notatus* in Key West, Florida, which contained 280 eggs. Such a log or piece of driftwood could easily be picked up by a flooded river or incoming tide and carried elsewhere, thereby depositing a nest full of eggs on shore and starting a new population.

The eggs of *Sphaerodactylus*, and of geckos in general, have hard calcareous shells which are nearly impervious to salt water. Brown and Alcalá (1957:39) demonstrate that the eggs of three species of Pacific geckos (*Cosymbotus platyurus*, *Gehyra mutilata*, and *Hemidactylus frenatus*) can be exposed to sea water for at least 11 days and remain viable.

The eggs, laid in communal nests and relatively unharmed by sea water, eliminate the need for a gravid female lizard or male and

female lizards to be transported to another island in order to start a new population—a single nest log is sufficient.

Logs and similar vegetative flotsam suitable for rafts are swept northward into the Lesser Antilles when the Orinoco River floods each summer. The North Equatorial Current, which picks up these rafts, sweeps northwest past the Orinoco and up into the Caribbean at the rate of 20 to 30 miles per 24-hour period (Sverdrup, Johnson, and Fleming, 1942:642). The average open water distance between adjacent islands from Trinidad to Anguilla is 24 miles. If the rate of drift of a raft were equal to the velocity of the current, it would take an average of one or two days to raft from one island to the next.

The wind in this same area blows from an easterly or northeasterly direction. This would not hinder the westward progress of a raft, but would greatly slow its northward drift.

Each year probably many animals, especially reptiles, are swept toward the Lesser Antilles on rafts. Guilding (1828) cites a boa constrictor (*Constrictor constrictor*) that drifted ashore on St. Vincent on the trunk of a cedar tree. Feilden (1889:298) states that an alligator (*Crocodylus intermedius*) rafted to Barbados on the trunk of a tree in 1886. Another *Crocodylus intermedius* came ashore on Grenada in 1910, with no apparent raft (Barbour, 1914:222).

Another example of the general direction of current drift in this island chain was supplied by the eruption of Mount Pelee on Martinique in 1902. Pumice and dugout canoes from this island drifted ashore in the Virgin Islands far to the north (Barbour, 1917a:97).

With adaptations for communal nesting and production of calcareous-shelled eggs, and with favorable winds and currents, I believe the presence of these lizards in the Lesser Antilles can best be accounted for by waif dispersal through rafting.

DISTRIBUTION

Underwood (1954a:128) states that the present distribution of *Sphaerodactylus* in the Lesser Antilles suggests that its dispersal is southward from the Greater Antilles. The basis for this is the apparent absence of the genus from Grenada, which he feels has been adequately collected. This statement also hinges on his belief that *Sphaerodactylus* has only recently entered South America (Underwood, 1954a:123). If the lizards are dispersing southward in the Lesser Antilles, they are being carried against the ocean currents, against the prevailing winds, and against the direction taken by cyclonic storms. If the geckos are being dispersed by means of wind

or water, it is more reasonable to assume that they are being moved northward from the South American continent. Barbour (1930, 1935, 1937) lists several reptilian genera whose distributions suggest this northward immigration—*Bothrops*, *Constrictor*, *Boa*, *Pseudoboa*, *Ken-tropyx*, *Iguana*, and *Thecadactylus*. These genera have a wide distribution on the mainland, but reach the West Indies only in the Lesser Antilles.

The little knowledge that we have of the Pleistocene herpetofauna of the Lesser Antilles suggests the same northward movements. During the Pleistocene, *Thecadactylus*, *Pseudoboa*, and a now extinct species of frog, *Hyla barbudensis*, related to the South American forms, occurred as far north in the island chain as Barbuda (Auffenberg, 1958). As *Sphaerodactylus* is unrecorded as a fossil, nothing can be stated positively about its movements to or from the mainland, north or south through the islands.

Barbour (1921:218) lists several morphological characters that he considers primitive or advanced for the genus *Sphaerodactylus*. An example of a primitive character that he uses is the presence of numerous small granular dorsal scales, which presumably gave rise to small keeled granular scales, and then to keeled scales, and ultimately to large strongly keeled scales. In order to determine which characters might be considered primitive and which advanced, I examined other members of the family Sphaerodactylidae (Underwood, 1954b:476), which contains five genera of lizards—*Coleodactylus*, *Gonatodes*, *Lepidoblepharis*, *Pseudogonatodes*, and *Sphaerodactylus*. Noble (1921:14) and Parker (1926:301) show that *Sphaerodactylus* may have been derived from an ancestral series of which *Gonatodes* represents the basal grade and *Pseudogonatodes*, *Lepidoblepharis*, and *Coleodactylus* are intermediate grades in the order of development. *Sphaerodactylus* then is considered most advanced. Their work is based largely on osteological characters and scutellation of the unguis sheath. The present distribution of these more primitive members of the family is limited to Central America and northern South America (Underwood, 1954b:476). The most advanced genus, *Sphaerodactylus*, occurs in Central America, northern South America, and the Antilles.

Examination of several species of *Sphaerodactylus* from all parts of the range shows that the mainland species possess the greatest number of presumed primitive characters. Primitive characters are defined here as those which form a basal grade capable of giving rise to other, i.e. advanced, characters. In addition, most primitive characters are close to the condition found in other members of the

family Sphaerodactylidae. Primitive characters used in this study include the granular dorsal scales mentioned by Barbour, smooth gular scales, smooth round ventral scales, dorsal scales with large scale organs bearing numerous hairs, and the escutcheon of the male long and lacking thigh extensions.

Analysis of series of these presumed evolutionary grades reveals nothing of the dispersal routes of these animals. Figures 14 through 16 show the distribution of several characters of scutellation and coloration. Such analyses do reveal that the most primitive species occur on the mainland of Central and South America, and the most advanced in the Antilles. Nothing more definite can be stated about the point of origin of *Sphaerodactylus* at present.

As mentioned above, no sphaerodactyl has yet been found in Grenada or the Grenadines. No sphaerodactyl is recorded from a number of additional islands, Sombrero, Redonda, Marie Galante, Iles des Saintes, and Barbados. Sombrero and Redonda are extremely small and remote: Sombrero is inhabited only by a crew of lighthouse tenders; Redonda is uninhabited. Few collectors have ever visited these islands, and chances are, if *Sphaerodactylus* exists on them, it was overlooked. Montserrat is a relatively large island and is inhabited. Its herpetofauna is supposedly well known (see *Sphaerodactylus f. ligniservulus*), but as late as 1958 it was possible to add two species as large and conspicuous as *Iguana* and *Geochelone* to the list of animals known to occur there (these specimens are in the University of Florida Collections). Grenada and the Grenadines are equally well known. For these islands—Sombrero, Redonda, Marie Galante, Iles des Saintes, Grenada, and the Grenadines—I believe sufficient collecting will demonstrate sphaerodactyls to be present.

Barbados seems genuinely to lack the animal. This island is exceptional among the southern Lesser Antilles because of the paucity of species in its reptile fauna (Barbour, 1930, 1935, 1937; Feilden, 1889: 295; Grant, 1959b:97). Extensive cultivation of sugarcane on the island has destroyed most of the original vegetation. This may account in part for the scarcity of reptiles. Grant (1959b:97) believes that most of the eight reptile genera present were introduced by man. He states that, "Barbados herpetology could be dismissed with the remark that in pre-columbian times the only reptiles were *Dromicus perfuscus* and possibly *Kentropyx intermedius* . . ." However, *Iguana iguana* is recorded as a Pleistocene fossil in Barbados (Swinton, 1937:306). All things considered, *Sphaerodactylus* probably does not occur in Barbados. The island lies approximately 100 miles east of the main chain of islands, and in this position is "upstream" in terms of ocean cur-

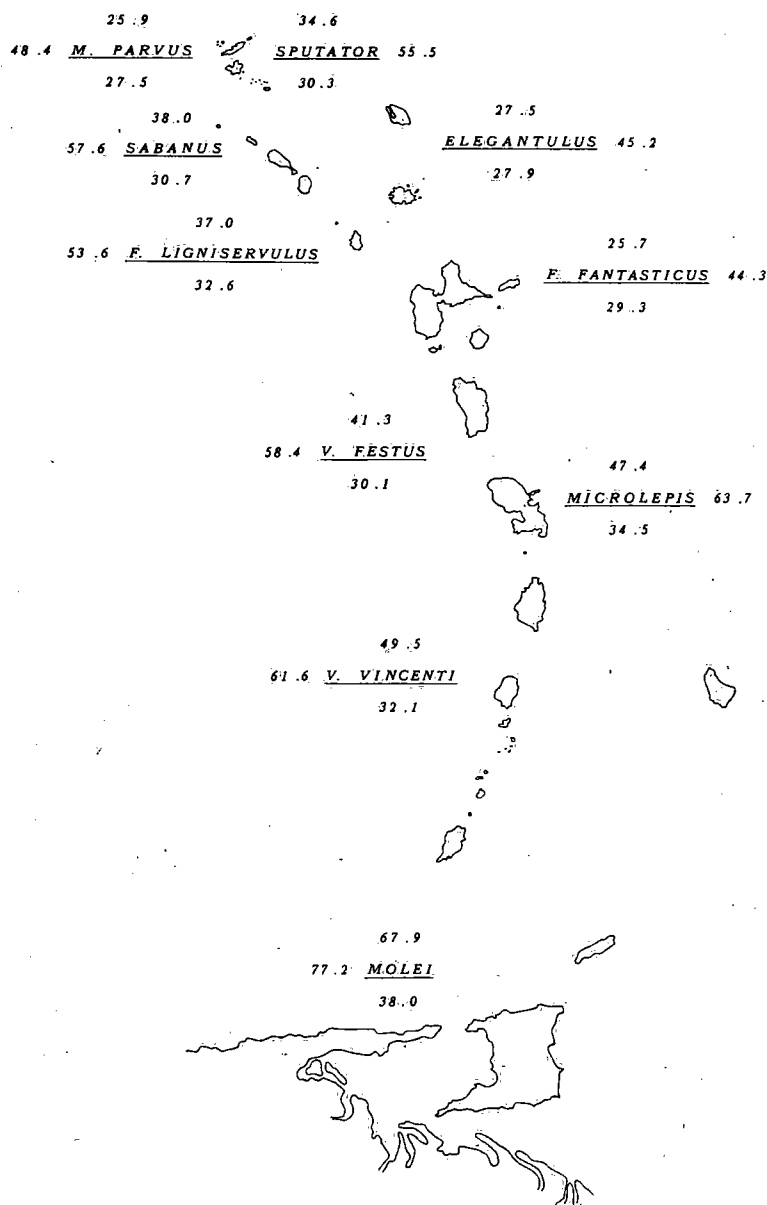


FIGURE 14. Geographic distribution of scale counts. Mean number of dorsal scales from axilla to groin is above the specific epithet; mean number of ventral scales, below the epithet; mean number of scale rows around midbody, beside the epithet.

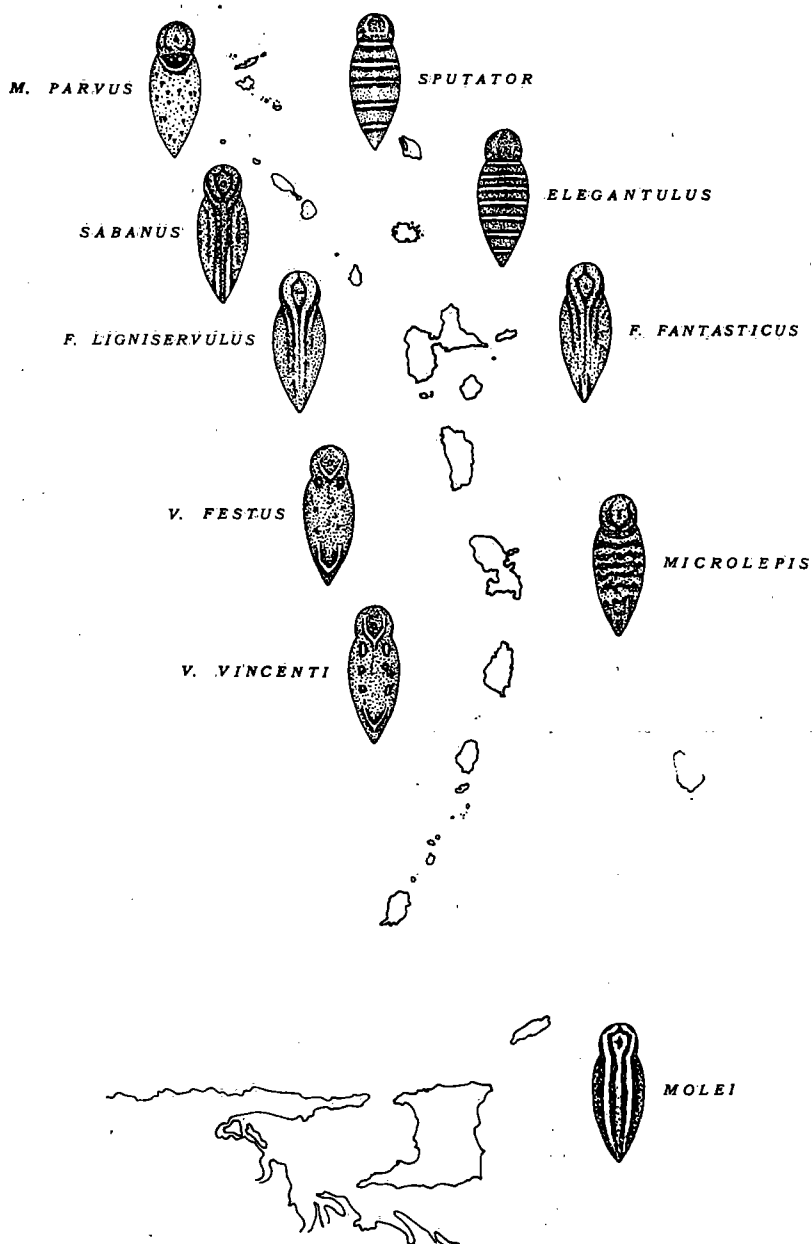


FIGURE 15. Geographic distribution of color patterns. The patterns are simplified presentations of the juvenile or young adult patterns.

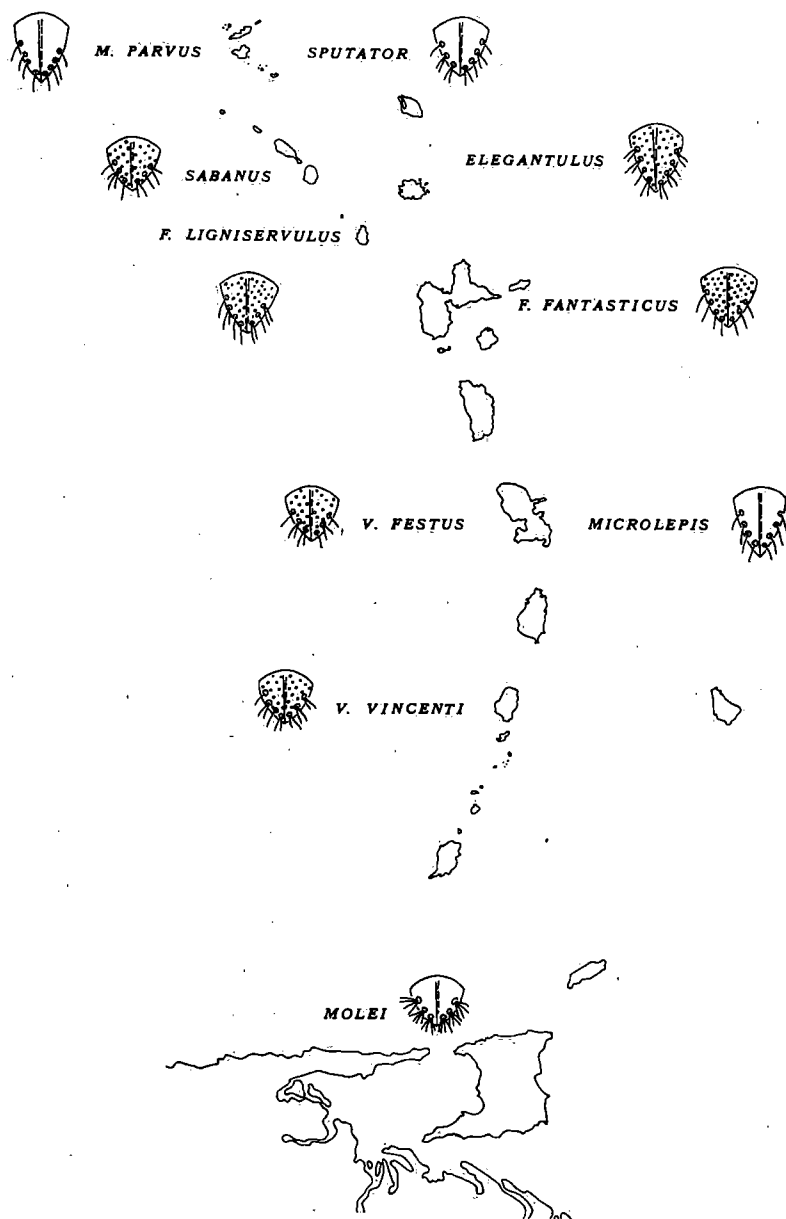


FIGURE 16. Geographic distribution of scale organs. The sizes of the organs are exaggerated for purposes of illustration.

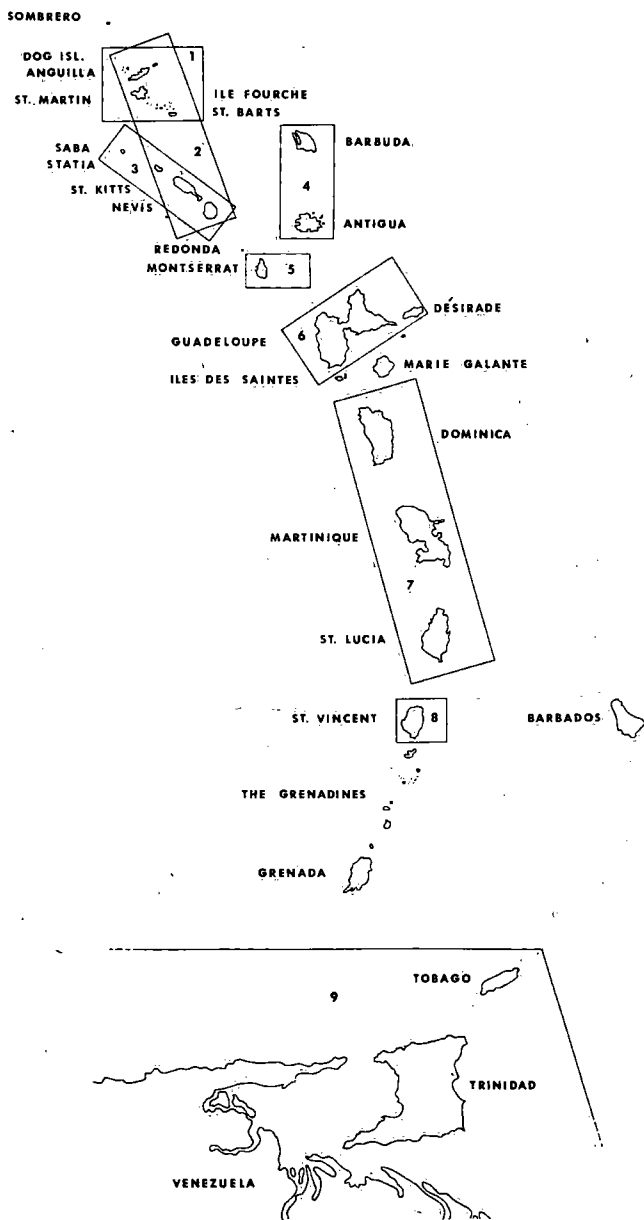


FIGURE 17. Geographic distribution of the races of *Sphaerodactylus* in the Lesser Antilles. (1) *S. macrolepis parvus*; (2) *S. sputator*; (3) *S. sabanus*; (4) *S. elegantulus*; (5) *S. fantasticus ligniservulus*; (6) *S. fantasticus fantasticus*; (7) *S. vincenti festus* and *S. microlepis*; (8) *S. vincenti vincenti*; (9) *S. molei*.

rents and wind directions and thus isolated from the main route of dispersal. A raft leaving the mainland of South America would have to cross a major part of the North Equatorial current to reach Barbados. This necessitates beginning its trip farther south on the coast of South America, possibly in the vicinity of Surinam, French Guiana, or Brazil. Even then the wind direction is unfavorable. Thus the chances of a raft reaching Barbados are slight indeed, which may account for its depauperate reptile fauna.

Figure 17 plots the known distributions of the races of *sphaerodactylus* in the Lesser Antilles and Trinidad.

SUMMARY AND CONCLUSIONS

Eight species of *Sphaerodactylus* are known from the Lesser Antilles and Trinidad—*S. elegantulus*, *S. fantasticus*, *S. macrolepis*, *S. microlepis*, *S. molei*, *S. sabanus*, *S. sputator*, and *S. vincenti*. Each of these species is described and illustrated.

Sparman's (1784) type series of *S. sputator* is shown to consist of two species. A lectotype, based on the largest of his specimens, is designated and redescribed.

A new race, *S. macrolepis parvus*, is described from Anguilla, Dog Island, St. Barts, St. Martin, and Tintamarre. It is distinguished from *S. macrolepis macrolepis* by its keeled chest scales.

A second race, *S. fantasticus ligniservulus*, is described from Montserrat. It is separated from *S. fantasticus fantasticus* by the fact that its dorsal scales are smaller and more numerous, and its ventral scales are never keeled.

S. monilifer is reduced to a synonym of *S. festus*. The color pattern and scutellation thought to be distinctive of *monilifer* are shown to be within the normal variation of *festus*. *S. festus* is itself considered to be conspecific with *S. vincenti*. The two forms are treated as subspecies, *S. v. vincenti* and *S. v. festus*. They are distinguishable by the number of dorsal scales from axilla to groin (36-49 in *festus*; 47-53 in *vincenti*), and slight differences in color pattern.

Because the Lesser Antilles have never been connected to the mainland of South America or to the Greater Antilles, waif dispersal is the only method of immigration open to these lizards. Rafting is believed to be the principal method of dispersal used by *Sphaerodactylus* because of adaptations for communal nesting and the laying of calcareous-shelled eggs impervious to sea water. The direction of immigration—in the Lesser Antilles—is thought to be northward into the islands from the South American mainland. Belief in dispersal by

means of rafting dictates this direction—ocean currents flow northwest across the islands, trade winds blow from an easterly or northeasterly direction, and cyclonic storms move west-northwest. However, paleontological evidence is unavailable to support or deny this proposed direction of dispersal. Distribution of primitive and advanced characters of morphology and coloration fails to reveal any clines that might reflect direction of immigration. The evidence at hand does not support any definite conclusion regarding the place of origin of the Lesser Antillean *sphaerodactyls*.

The species in the Lesser Antilles are closely related to and possibly conspecific with species widespread in the Greater Antilles (*S. macrolepis* with *S. difficilis*, *S. grandisquamis*, and *S. notatus*) and on the mainland (*S. molei* with *S. lineolatus*).

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