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THE ANOLINE LIZARDS OF JAMAICA

by

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CONTENTS

Introduction	5
History of the classification	6
General remarks	6
Key to the groups of Jamaican anoles	9
Localities	12
Systematic section	16
<i>Xiphocercus valencienni</i> (Duméril & Bibron)	16
<i>Anolis sagrei</i> Duméril & Bibron	17
<i>Anolis garmani</i> Stejneger	20
<i>Anolis grahami</i> group	21
<i>A. opalinus</i> Gosse	21
<i>A. grahami grahami</i> Gray	24
<i>A. grahami aquarum</i> subsp. nov.	28
<i>Anolis lineatopus</i> group	29
<i>A. lineatopus lineatopus</i> Gray	31
<i>A. lineatopus merope</i> subsp. nov.	36
<i>A. lineatopus neckeri</i> Grant	38
<i>A. lineatopus ahenobarbus</i> subsp. nov.	40
Areas of intermediate populations	42
<i>A. reconditus</i> sp. nov.	44
General discussion	46
Acknowledgements	48
Literature cited	48

INTRODUCTION

As is well known, the section of the family Iguanidae comprising the lizards commonly known as anoles is extremely well represented in the West Indies. Jamaica is no exception in this respect. Anoles swarm over the island and show a remarkable measure of geographical variation in an area smaller than the county of Yorkshire, England, or the state of Connecticut, U.S.A. From a systematic standpoint, the situation is complex and virtually impossible of resolution without experience of the animals in the field. Unfortunately a number of the names in the literature were established on old preserved material by persons who had never seen the lizards in life.

A happy combination of circumstances has made possible this joint account. One of us (Williams) has twice toured the island on collecting trips and has been able, whilst in Europe on a Guggenheim fellowship, to examine the important type material in the British Museum. The other (Underwood) is resident in the island (at Mona, near Kingston) and has been able to make repeated field trips mapping distribution patterns and becoming acquainted with the animals in life. We have both examined the Jamaican material in the Museum of Comparative Zoology (this includes an important part of the Chapman Grant collection reported by him in *The Herpetology of Jamaica*, and certain of the material collected by B. & M. Hecht, K. Koopman and E. Williams in 1950), material collected by Underwood over several years (1948-58) and the material in the Museum of the Institute of Jamaica. One of us (Williams) has also examined the Jamaican material in the American Museum of Natural History. It is hoped that our arrangement of the names already in the literature will prove stable, and acceptable to other workers. In only one species has any radical change of the nomenclature used by Grant (1940) been necessary. *Anolis iodurus* Gosse (*A. grahami iodurus*, Grant) is a synonym of *A. grahami* Gray. For the form called *A. grahami grahami* by Grant we use the name *A. grahami aquarum* subsp. nov.

We also take this opportunity to describe several new forms that have been recently discovered, but we do not for a moment pretend that this is a final and complete account of the Jamaican anoles. Field experience makes it clear that any such claim would be extremely rash. We have endeavoured to illuminate the many problems and to provide a satisfactory foundation for further studies by giving guidance to the field worker and as much information as possible to help the

museum worker. It should be noted that no attempt has been made to give a complete description of the forms, including all the details of squamation and its variations; our purpose is to aid in the recognition of the Jamaican forms.

HISTORY OF THE CLASSIFICATION

KNOWLEDGE of Jamaican anoles begins with the description of specimens of unknown origin in European museums. It is curious that the first to be described, *Xiphocercus valencienni* by Duméril and Bibron in 1837, is the least frequently encountered in the field. These authors also described *Anolis sagrei*, but from Cuban material. Gray followed in 1845 with inadequate descriptions of *Anolis grahami* (originally under a preoccupied name) and *Anolis lineatopus* (♀ and ♂ as different species). Philip Gosse, resident in Jamaica for 18 months from 1844–1846, for the first time described animals of known provenance from life. Unfortunately, of the several new names which he proposed on the basis of good descriptions, only *opalinus* stands today. He can scarcely be blamed for not knowing that a number of forms had already been described without locality. For the next sixty years there were no contributions by workers familiar with the island or the animals in life. The distinctness of *opalinus* was not recognised by Boulenger and others during this time, apparently because of confusion in regard to the supposed British Museum type (see p. 23), a confusion which led Cope in 1894 to propose a new name, *flabellatus*, for this form which we place in the synonymy of *opalinus*. Stejneger in 1899 realized that the large green anole of Jamaica had been called by a name belonging to a lizard of the Lesser Antilles and so proposed *Anolis garmani* for the Jamaican lizard. Barbour (1910) knew the island and the lizards in life. He recognized two geographical forms of *Anolis grahami* but several bottles of Barbour's specimens in the Museum of Comparative Zoology examined by us contained mixtures of species, and one bottle which was labelled *Anolis iodurus* (= *grahami*) contained *grahami*, *opalinus* and *garmani*. Grant (1940) was the first worker to make any serious attempt to collect in all regions of the island. He was aware that the *grahami* and *lineatopus* groups consist of complementary geographic forms and gave information on the ecological preferences of the several forms. His work greatly outranks Barbour's as a basis for the present account.

GENERAL REMARKS

In order to make our descriptions as clear as possible we give below an account of certain taxonomically valuable general features of the Jamaican anoles.

Scales: – In describing the squamation the scales are described as flat or swollen, smooth or rugose, keel-less or keeled.

Head: – Above each orbit is a row of enlarged supraorbital scales (supraorbital semicircles) which are continued forwards some distance as frontal ridges bounding a mesial frontal area which may be depressed. In each supraorbital row is a scale crossed by an imaginary line joining the anterior margins of the two orbits; this may be called the first orbital member of the row. In front of this there are generally one or two scales recognizable as members of the frontal row continuing the supra-orbital row. The scale immediately before the first orbital may be called the posterior frontal. The relative sizes of posterior frontal and first orbital sometimes afford a useful character. There may be an eminence on the snout between the nostrils. A row of strongly-keeled scales forms a very marked canthal ridge. An arc of scales with collinear keels forms a subocular row (subocular semicircle); the anterior member of this row is usually clearly recognizable, and the number of scales separating it from the canthal ridge is sometimes a useful character. Several rows of loreal scales lie between canthals, supralabials and suboculars. The count of loreal rows is not always clear, but fair consistency may be obtained by counting the number of scales in a vertical line from canthal ridge to supralabials through the loreal immediately anterior to the anterior subocular. The orbit is surmounted by a group of enlarged scales surrounded by small granular scales; the large scales are clearly distinguishable from the surrounding scales and are called the supraocular disc. Comparison between the size of the supraocular disc and the interparietal scale is sometimes useful. The interparietal scale, in which is a small transparent window over the pineal (parietal) organ, is always very distinct and may be in a depression. This scale is often inappropriately called the occipital. (In several lizard families the occipitals are a pair of quite different scales). The posterior ends of the labial rows are not easily defined and the labials are counted forwards from the scale or scale margin immediately beneath the centre of the pupil.

Digits: – Each digit is covered dorsally by a median row of broad scales which may or may not be keeled. Beneath is a row of transversely enlarged lamellae. The proximal end of a lamellar row is not easily defined, and counts are here made on the fourth hind toe beginning with the lamella level with the web between third and fourth toes.

Dorsum and tail: – One or more rows of mid-dorsal scales are sometimes differentiated from the laterals. From the sacrum there runs back a well defined mid-dorsal row of scales onto the tail. The scales on the tail are in whorls corresponding to the autotomy segments. Each whorl has a single dorsal row of enlarged scales, one or two rows of ventral scales and laterally several rows of smaller scales. Counts of the dorsal and ventral scales in a whorl are made near to the base of the tail where after the first few whorls they become relatively stable.

Colour: – A considerable source of difficulty is the extent of colour change which many anoles undergo. The general integument including the interstitial skin may be

orange, yellow, green or blue. Browns and blacks are due to pigment in chromatophores always directly below the scales. The colours due to the pigment in chromatophores may vary greatly in one individual, from invisibility to black in some cases. Consequently patterns of spots, mottling, bands and stripes as well as general colour tone may be of quite uncertain significance if one does not have experience with the live animals. The non-chromatophore colours (some are fugitive in alcohol), though not subject to change in the living animal, may be completely masked by the chromatophores. Thus a brilliant emerald-green lizard may become dead black in ten seconds. There is in some forms considerable pigmentation of the pericardium, in others it is unpigmented or very lightly pigmented. Our study is based primarily on specimens taken by a noose and observed alive before preservation. Only in this way can one distinguish the colour variations possible in one individual from those differences which are significant in the discrimination of the several taxonomic units.

Gular fan: - The fan merits special mention. It is supported by a backward extension of the basihyoid which may reach to the pelvic region and when retracted may be curled at the end because of its length. The scales are widely spaced on the fan and there is extensive wrinkled interstitial skin. They may show a tinge of green or brown where this is part of the general body colour, or they may show the colour of the interstitial skin. The interstitial skin may be yellow, orange or red. Sometimes the fan is coloured to the margin; commonly the periphery is paler.

The males of the various forms are far more clearly differentiated than the females. The possession of a fan by the male contributes to this, but the colour pattern of the males is always more distinctive. In some cases females are almost impossible to distinguish. We have accordingly attempted a clear characterization of the male of each form and have added comments on the female. Descriptions of species founded only on female material are of limited value.

It is worthwhile at this point to comment on the importance of vision for the anoles. The eyes are outstandingly well developed (Underwood, 1951). As far as can be made out the lizards identify and pursue prey entirely by sight. They run about trees with agility and make accurate leaps from branch to branch. These lizards occupy definite territories. Males defend their territories against others of their kind but tolerate members of different species. An encounter between two males is accompanied by spreading of the fan and erection of the nuchal and dorsal crests. A displaying male turns broadside on to his opponent, thus presenting the maximum visual effect. Males also invariably display as a preliminary to mating. Colour vision, although not experimentally demonstrated, must surely be of cardinal importance to the lizards in the recognition of species.

We follow the useful practice of Smith & Taylor (1941) and other authors, and use the term "form" to mean a species or subspecies, and the term "group" to mean an assemblage of related forms within a genus. Those populations which are statistically recognizable, but in which the constituent individuals are not con-

sistently distinct from those of other populations, have not been recognized as subspecies. Our subspecies differ from allopatric species in that there are areas of intergradation. In the field, the difference between the populations which we recognize as subspecies and the populations of lower rank is clear and convincing. To accord them equivalent nomenclatural status would obscure their biological status. As infrasubspecific local populations have no nomenclatural standing we accord them informal locality names. In selecting type localities we have sought to avoid, where the material permitted, areas likely to be compromised by intergradation.

We here recognize eleven forms of Jamaican anoles arranged in five groups. These are grouped only as we see them in the island. Without doubt the Jamaican groups are only parts of more widely distributed groups.

NAME OF GROUP	INCLUDED FORMS
<i>Xiphocercus</i> group	<i>X. valencienni</i> (Duméril & Bibron)
<i>Anolis sagrei</i> group	<i>A. sagrei</i> Duméril & Bibron
<i>Anolis garmani</i> group	<i>A. garmani</i> Stejneger
<i>Anolis grahami</i> group, two sympatric subgroups: -	
<i>A. opalinus</i> subgroup	<i>A. opalinus</i> Gosse
<i>A. grahami</i> subgroup, two geographical forms: -	
	<i>A. grahami grahami</i> Gray
	<i>A. grahami aquarum</i> subsp. nov.
<i>Anolis lineatopus</i> group, five geographical forms: -	
	<i>A. lineatopus lineatopus</i> Gray
	<i>A. lineatopus merope</i> subsp. nov.
	<i>A. lineatopus neckeri</i> Grant
	<i>A. lineatopus ahenobarbus</i> subsp. nov.
	<i>A. reconditus</i> sp. nov.

KEY TO THE GROUPS OF JAMAICAN ANOLINE LIZARDS

1. Frontal area with few, large, flat scales (8-10); fine granules between large, flat, keel-less, lateral and dorsal scales.
Interparietal meeting, or nearly meeting, supraorbital semicircles; a soft-skinned, grey lizard with a red fan in both sexes: -
. *Xiphocercus valencienni*
2. Frontal area with numerous small scales (12 or more); lateral and dorsal scales small, swollen (granular) or flat, keeled or not, scales not separated by fine granules 3
3. Lateral and dorsal scales flat, smooth and sharply keeled; labials not more than 5.

Belly scales with sharp keels in lines; a small lizard of brown general appearance with a fan ranging from vermilion to burnt umber in males: - . . .

- *Anolis sagrei*.
4. Lateral and dorsal scales more or less swollen, never sharply keeled; supralabials more than 5
. 5
5. Dorsal and lateral scales about as long as ventrals (although they may be narrower), in rather regular vertical rows, usually mid-dorsally a single row of elongated scales which form the crest in the male. Supradigital scales unkeeled or but faintly keeled; a large, emerald-green lizard (black in dark phases): - *Anolis garmani*.
6. Mid-dorsal scales never markedly elongate; all dorsal scales distinctly smaller than ventrals and never very regularly arranged; supradigital scales with multiple keels 7
7. Keels of supraorbital rows continued forwards into frontal ridges which enclose a distinctly depressed frontal area (more strongly depressed in males); subdigital lamellae rarely more than 31; pericardium unpigmented or but slightly pigmented: -
. *Anolis lineatopus* group.
8. Supraorbital ridges not, or indistinctly, continued forwards to frontal area which is more or less flat; subdigital lamellae usually more than 31; pericardium deeply pigmented: -
. *Anolis grahmi* group.

We must confess that the last two alternatives of this key are not entirely satisfactory. Unhappily we have been unable to find reliable characters, suitable for incorporation in a formal key, which will in all cases effect the separation of the *grahmi* and *lineatopus* groups. Pericardial pigmentation appears to be the most reliable character. A majority of the specimens belonging to these groups will be correctly separated by the characters given above; but the great amount of both individual and geographic variation to be found in these groups has defeated our efforts to frame a wholly adequate key. Fortunately, in the field and with material the provenance of which is known, the situation is simplified by the fact that in any one locality (except in the limited areas, to be mentioned below, of intergradation and overlap) no more than three representatives of these difficult groups will be found together.

Characteristic of each region is a large and a small member of the *grahmi* group and a member of the *lineatopus* group. Within each region these three forms are always clearly distinguishable in life on colour characters. In preserved material, of course, these colours are frequently lost and the characters of squamation do not always permit the certain determination of every specimen.

Below we attempt to give the recognition characters (effectively short diagnoses)

of the several members of the *grahmi* and *lineatopus* groups. [See the account of each form for a more extended description].

The small member of the *grahmi* group, *opalinus*, shows no geographical forms worthy of nomenclatural recognition.

Recognition characters of *opalinus*: - A small anole ranging in general colour from olive through olive-brown to grey, *always with a light stripe on the flank as wide as the forelimb*; belly scales with a pearly iridescence quite without keels.

The large members of the *grahmi* group represent two geographical forms: *grahmi* which occurs in the central and western parts of the island and *aquarum* found only in Portland and St. Thomas (fig. 3).

Recognition characters of *g. grahmi* Gray: - *An anole which grades from yellowish-green anteriorly on back and sides to blue-green on the hind quarters*, with some blue or purple around the base of the tail, with mottling generally visible on the head and neck, becoming nearly black in dark phase; interparietal scale about as large as the supraocular disc; keeling of belly scales variable but generally slight or absent (fig. 4).

Recognition characters of *g. aquarum* subsp. nov.: - A nearly uniformly bright emerald-green lizard with usually a little blue at the base of the tail, mottling when visible finer than in *grahmi*; interparietal generally not more than half the size of the supraocular disc; *belly scales with sharp keels forming lines* (fig. 4).

The *lineatopus* group comprises five geographical forms. [See the distribution map for the range of each form (fig. 5).]

Recognition characters of *l. lineatopus* Gray: - An anole of brown general appearance with *variegated*, dark, transverse bands and two narrow light lines on side; chin faint yellow in centre; fan medium orange, usually with a yellow border, fan scales thin and flat, like watermelon seeds; belly scales keeled. *No pattern change, very little colour change* (fig. 6).

Recognition characters of *l. merope* subsp. nov.: - An anole of brown general appearance with *uniform* brown transverse bands visible only in darker phase; chin russet; fan with more or less restricted dark or light orange centre and grey margin; fan and belly scales as in *l. lineatopus*. *A patternless buff phase occurs, very little colour change* (fig. 6).

Recognition characters of *l. neckeri* Grant: - An anole ranging from brown to green in general appearance, brown transverse bands crossed by a distinct line from shoulder to hip; fan dark orange nearly or quite to margin; chin more or less orange; fan scales less flattened than in *l. lineatopus*; belly scales more strongly

keeled, keels tending to form distinct lines. A patternless phase with a distinct green colour occurs (fig. 6).

Recognition characters of *I. ahenobarbus* subsp. nov.: – An anole ranging from brown to green in general appearance, transverse bands as in *I. merope* or irregular and variegated; chin bright orange-yellow; fan with extensive dark orange or brown centre and more or less limited grey margin; fan scales swollen, coarsely granular, like grains of wheat; belly scales as in *I. lineatopus*. A light phase occurs with whole of dorsum more or less green, patternless or with irregular bands (fig. 6 & Pl. IIIa).

Recognition characters of *I. reconditus* sp. nov. (based on only known specimen): – An anole of sombre greens and browns, transverse bands uniformly dark, distinct only mid-dorsally; chin grey, temporal region and sides of neck dark slate; fan orange-brown to margin, fan scales swollen keeled, coarsely granular; belly scales keel-less; a single row of ventral scales beneath tail. No pattern change, little colour change (fig. 6).

A discussion of the wider affinities of the Jamaican anoles would be beyond the scope of this study. Clearly a full interpretation of the anoline lizards of Jamaica, must take account of their relatives in other islands. A general analysis of the anoles of the Caribbean would represent a considerable undertaking for which adequate data are not yet available.

Similarly although we do not feel that there is a good case for the recognition of the genus *Xiphocercus*, we refrain from suppressing it, for the implications of this action would have repercussions outside the island. *Anolis darlingtoni* Cochran 1939 would become a secondary homonym of *Xiphocercus darlingtoni* Cochran 1935.

LOCALITIES

THE extensive duplication of place names in Jamaica can be a source of great confusion. A further difficulty is that until recently no good map has been available. The road map, published by the Survey Department, Jamaica, contains certain inaccuracies but gives place names in great detail. Localities are all given so that they may be found on the new 1:250,000 layer tinted contour map published by the Director of Colonial Surveys. Latitude and longitude of lesser known localities is given to assist those not familiar with the island. Distances with relation to towns are measured from the post office. Rivers are located at the point at which they are crossed by the coast road. In listing localities, abbreviations for parishes are used as indicated below.

SKETCH MAP OF JAMAICA

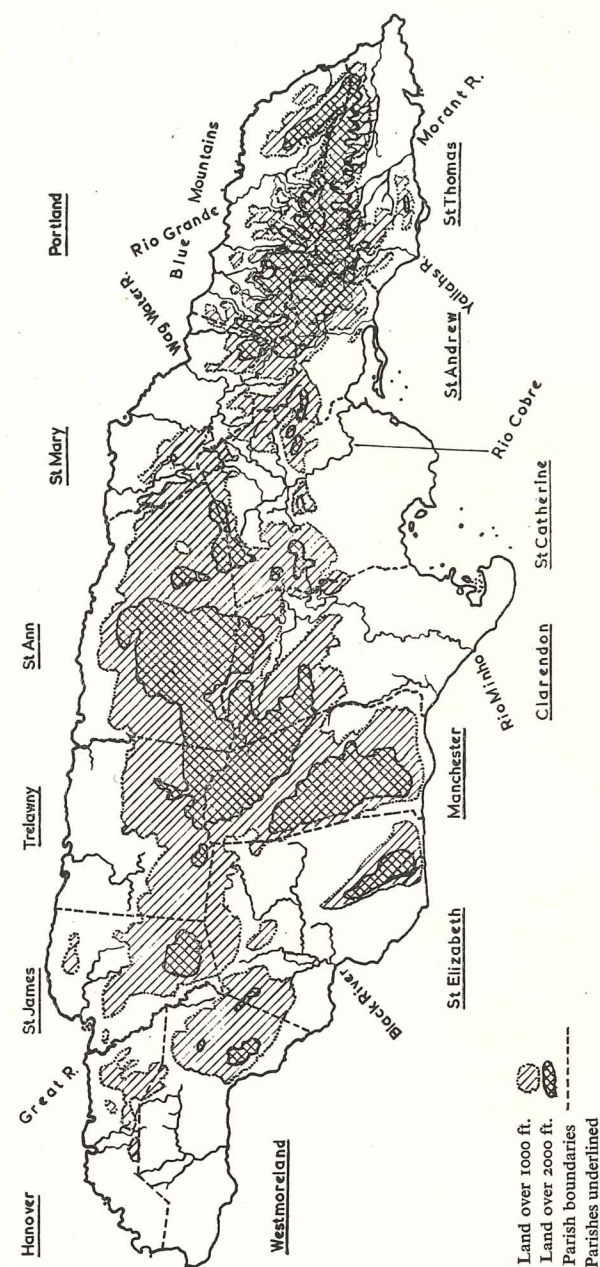


Fig. 1. General map of Jamaica showing parishes, mountains and principal river basins.

St. Thomas - St T.

Arntully - $18^{\circ}0\frac{1}{2}'N$ $76^{\circ}36'W$
 Beacon Hill - $17^{\circ}57'N$ $76^{\circ}21'W$
 Cedar Valley - $17^{\circ}59'N$ $76^{\circ}35'W$
 Emerald I. - $17^{\circ}52'N$ $76^{\circ}18\frac{1}{2}'W$
 Johns Pen - 3 km. W Port Morant

Pleasant Hill - $17^{\circ}55\frac{1}{2}'N$ $76^{\circ}17\frac{1}{2}'W$
 Rozelle Falls - $17^{\circ}52'N$ $76^{\circ}28'W$
 Silver Hill - $17^{\circ}57'N$ $76^{\circ}57'W$
 Swimmers Bay - $17^{\circ}52\frac{1}{2}'N$ $76^{\circ}23\frac{1}{2}'W$
 Whitehall - $17^{\circ}57'N$ $76^{\circ}27'W$

Kingston & St. Andrew - KStA.

Chestervale - 1.2 km. WSW Clydesdale
 Clifton - 2.5 km. SW Clydesdale
 Clydesdale - $18^{\circ}5'N$ $76^{\circ}40'W$

Mona (University College of the West Indies) - $18^{\circ}0'N$ $76^{\circ}44\frac{3}{4}'W$
 St. Peters - 1.7 km. SW Clydesdale
 Whitfield Hall - $18^{\circ}3'N$ $76^{\circ}37'W$

St. Catherine - StC.

Back Pasture - $18^{\circ}3'N$ $77^{\circ}5'W$
 Darling Spring - $18^{\circ}11'N$ $76^{\circ}56'W$
 Mango Grove - $18^{\circ}12'N$ $77^{\circ}1'W$
 Mt. Industry - $18^{\circ}8\frac{1}{2}'N$ $76^{\circ}54\frac{1}{2}'W$

Mt. Rosser - $18^{\circ}11\frac{1}{2}'N$ $77^{\circ}5\frac{1}{2}'W$
 Riversdale - $18^{\circ}10'N$ $76^{\circ}58'W$
 Watermount - $18^{\circ}3\frac{1}{2}'N$ $77^{\circ}5\frac{1}{2}'W$

Clarendon - C.

Breadnut Gully - $17^{\circ}52'N$ $77^{\circ}9\frac{1}{2}'W$
 Kellitts - $18^{\circ}10'N$ $77^{\circ}13\frac{1}{2}'W$

Pennants - $18^{\circ}6\frac{1}{2}'N$ $77^{\circ}18'W$

Manchester - M.

Fairfield - $18^{\circ}1'N$ $77^{\circ}34\frac{1}{2}'W$
 Penzance - $18^{\circ}7'N$ $77^{\circ}29'W$

Whitfield Turn - $18^{\circ}1\frac{1}{2}'N$ $77^{\circ}23\frac{1}{2}'W$

St. Elizabeth - StE.

Bogue - $18^{\circ}7\frac{1}{2}'N$ $77^{\circ}38\frac{1}{2}'W$
 Elim - $18^{\circ}7'N$ $77^{\circ}41'W$
 Happy Grove - $18^{\circ}8'N$ $77^{\circ}53'W$

Pepper - $18^{\circ}1'N$ $77^{\circ}36'W$
 Springfield - $18^{\circ}10\frac{1}{2}'N$ $77^{\circ}52\frac{1}{2}'W$

Westmoreland - W.

Homers Cove - $18^{\circ}13'N$ $78^{\circ}17'W$
 Lochiel - $18^{\circ}12\frac{1}{2}'N$ $78^{\circ}6\frac{1}{2}'W$

Old Hope - $18^{\circ}13\frac{1}{2}'N$ $78^{\circ}13\frac{1}{2}'W$

Hanover - H.

Cash Hill - $18^{\circ}22\frac{1}{2}'N$ $78^{\circ}7'W$
 Dolphin Pen - $\frac{1}{2}$ km. NE Dolphin Head
 Halfmoon Bay - $18^{\circ}23\frac{1}{2}'N$ $78^{\circ}18'W$

Halfmoon Cay - 50 m. offshore
 Haughton Court - $18^{\circ}26\frac{1}{2}'N$ $78^{\circ}12\frac{1}{2}'W$
 Pennycooke - $18^{\circ}21\frac{1}{2}'N$ $78^{\circ}6'W$

St. James - StJ.

Greenwood - 9 km. WSW Little River

Lapland - $1\frac{1}{2}$ km. SSW Catadupa

Trelawny - T.

Albert Town - $18^{\circ}17\frac{1}{2}'N$ $77^{\circ}32\frac{1}{2}'W$

Windsor - $18^{\circ}21'N$ $77^{\circ}39'W$

St. Ann - StA.

Antrim - $2\frac{1}{2}$ km. SE Runaway Bay
 Eaton Hall - at Runaway Bay

Eltham - $1\frac{1}{2}$ km. SSW White River

St. Mary - StM.

Clonmel - $18^{\circ}14'N$ $76^{\circ}51'W$
 Frankfort - $18^{\circ}20\frac{1}{2}'N$ $77^{\circ}4'W$

Grays Inn (nr. Annotto Bay)
 $18^{\circ}15\frac{1}{2}'N$ $76^{\circ}47'W$
 Troja Gap - $18^{\circ}12'N$ $76^{\circ}55'W$

Portland - P.

Caenwood - $18^{\circ}12'N$ $76^{\circ}34\frac{1}{2}'W$
 Christmas River - $18^{\circ}3\frac{1}{4}'N$ $76^{\circ}17\frac{1}{4}'W$
 Downers Bluff - $18^{\circ}12'N$ $76^{\circ}30'W$
 Ecclesdown - $18^{\circ}3'N$ $76^{\circ}20\frac{1}{2}'W$

Fair Prospect - $18^{\circ}7'N$ $76^{\circ}20'W$
 Folly Point - $18^{\circ}11'N$ $76^{\circ}26\frac{1}{2}'W$
 Soldiers Bay - $18^{\circ}10\frac{3}{4}'N$ $76^{\circ}26'W$
 Woods Island - 50 m. E Folly Point

SYSTEMATIC SECTION

(Refer to pp. 738 for definitions of terms and counts used).

XIPHOCERCUS VALENCIENNI (Duméril & Bibron)

Anolis valencienni Duméril & Bibron (1837). *Erp. gén.*, 4: 131. Type in Paris Museum, type locality unknown. Coll. Dr. Leach.

Dactyloa (Xiphocercus) valencienni, Fitzinger (1843). *Syst. Rept.*, 67.

Placopsis ocellata Gosse (1850). *Ann. Mag. Nat. Hist.*, 2:334

Types in British Museum, type locality Cave, Westmoreland (18°12'N 78°3'W). Coll. P. H. Gosse.

Juv. 1946.8.5-53, ♂1946.8.29.23-24. ♀1946.9.7.3-5.

Anolis leucocephalus Hallowell (1856). *Proc. Acad. Nat. Sci. Phila.* 1856:226, 231.

Xiphocercus valenciennesii, Boulenger (1885). *Cat. Liz. Brit. Mus.*, 2:9.

Xiphocercus valenciennesi, Grant (1940). *Bull. Inst. Jamaica, Sci. Ser.*, 1:81.

Description: - A heavy-bodied lizard, with a large head and relatively short tail. Head: - a) scales of the supraorbital semicircles very bluntly keeled, semicircles in contact or separated by one scale; posterior frontal shorter than first orbital. b) frontal area flat with large flat keel-less scales, 8-10 in number. c) no internarial eminence. d) supraocular and subocular scales not keeled. e) canthal ridge distinct only posteriorly, keels on canthal scales blunt. f) subocular row meeting canthal ridge or only one scale intervening. g) 7-8 labials. h) 3 rows of loreals. i) interparietal variable in size, typically elongate with straight sides, meeting supraorbital semicircles or with one scale intervening. j) ear opening small, round. Fan: - large, present and well developed in the female also; close set, swollen, keel-less scales at periphery; centre mostly bare with few, scattered, irregular, swollen, keel-less scales.

Trunk: - low erectile fold from occiput to sacrum; dorsal and lateral scales flat, keel-less, not imbricating; with tiny interstitial granules; belly scales smaller than laterals, larger than dorsals, flat, keel-less, nearly quadrangular, more or less regularly arranged in transverse rows.

Limbs and digits: - scales of limbs without keels; supradigital scales keel-less; subdigital lamellae 31-36.

Tail: - tail whorl with 3 dorsal and 3 ventral scales; mid-dorsal and ventral series sharply keeled, a low keel also on a mid-lateral horizontal row; male with enlarged postanal scales.

Colour: - General colour grey, in the dark phase becoming quite brown; five or six irregular black bands across body; irregular dark markings on limbs; transverse dark bands on tail; dark markings on occipital and temporal regions of the head;

sometimes dark spots on labials; lips frequently tinged with sulphur yellow. Fan with white scales, interstitial skin creamy red or purple red. Belly white. The female is very similar to the male.

Dimensions: - Adult male, snout to vent ca. 80 mm, tail ca. 110 mm; female, snout to vent 65 mm, tail ca. 85 mm; newly hatched young, snout to vent 23 mm, tail 32 mm.

Range: - This lizard is generally distributed throughout the island in suitable localities up to about 4000 feet. Although recorded along the south coast at numerous localities from Negril to Port Morant it has not been found on Portland Ridge or in the Hellshire Hills. Along the north coast it is known from Haughton Court to Port Antonio.

It occurs in the John Crow Mountains, and in the Blue Mountains has been recorded in the upper Yallahs valley at Clydesdale (3500 ft.) and Clifton (4000 ft.). Recorded from: - StT., Port Morant, Bath, Cedar Valley, Richmond Vale, Arntully; KStA., Kingston, Mona, Papine, Constant Spring, Hope Gardens, Clydesdale, Chestervale, Clifton; StC., Port Henderson, Gt. Salt Pond, Old Harbour, Spanish Town; C., Spaldings, Kellitts; M., Mandeville, Alligator Pond; StE., Calabash Bay, Pedro Plains, Balaclava; W., Lochiel, Carmel, Negril, Homers Cove; H., Haughton Court; StJ., Montego Bay, Montego Bay Point, Greenwood; T., Windsor, Stewart Town; StA., Clarendon, Mount Diablo; StM., Highgate, Castleton; P., Port Antonio, 3 km W. Ecclesdown.

Discussion: - The detailed original description of this form, although without any indication of locality, permits it to be distinguished with certainty from the Haitian *X. darlingtoni* Cochran, the only other species of the genus.

This form is probably far commoner than the number of specimens collected would suggest for it is very clever at concealing itself. When discovered, it lies close against a branch and rotates itself slowly round to the side opposite to the observer. In addition, to the human eye, the colouration confers an excellent protective resemblance to grey tree bark.

Through the kindness of Dr. W. G. Lynn one of us received the first recorded specimen of this form without red colouration in the fan. It was a female collected at Highgate, St. Mary, 1.ix.49. The fan was greyish-yellow with a pale yellow border. On 4.ix.49 it laid a single egg. Fifty four days later the egg hatched and from it emerged an individual with a red fan. Later one of us (Underwood) took a male without red colouration of the fan in the same area.

ANOLIS SAGREI Duméril & Bibron

Anolis sagrei Duméril & Bibron (1837). *Erp. gén.*, 4: 149.

Type in Paris Museum, type locality Cuba. (? Cotype M.C.Z. 2172, received from the Jardin des Plantes).

Draconura catenata Gosse (1850). *Ann. Mag. Nat. Hist.*, 2 : 346.

Type in British Museum, 47.12.27.49 = 1946.8.29.21, type locality Bluefields, Westmoreland. Coll. P.H. Gosse.

Anolis sagrae, Boulenger (1885). *Cat. Liz. Brit. Mus.*, 2 : 40.

Anolis sagrei, Grant (1940). *Bull. Inst. Jamaica, Sci. Ser.*, 1 : 95.

Description: - a fairly small anole, with a sharply tapering snout.

Head: - a) scales of supraorbital semicircles sharply keeled, semicircles separated by 1 or 2 scales b) posterior frontal scale shorter than the first orbital; frontal area moderately depressed, with small to moderate scales (ca. 15), sharply keeled, anteriorly often with multiple keels c) no internarial eminence d) supraocular and subocular scales sharply keeled e) canthal ridge very distinct and sharp f) anterior subocular separated from canthal ridge by 1 or occasionally 2 scales g) 5 upper, 4-5 lower labials h) 5 rows of loreals i) interparietal slightly smaller than supraocular disc, elongate, tapering posteriorly, separated from the supraorbital rows by 1-3 scales j) ear opening moderate, vertical.

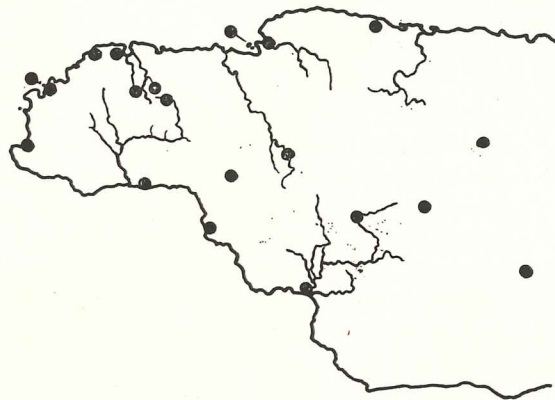


Fig. 2. Map showing records of *Anolis sagrei* in western Jamaica.

Fan: - small, in male only; several close-set rows of small keeled scales at periphery; more widely spaced rows of larger keeled scales across centre.

Trunk: - a prominent erectile nuchal fold in males, and erectile mid-dorsal fold; 2 or more rows of mid-dorsal scales slightly enlarged but not different in shape from the lateral scales; all dorsal and lateral scales sharply keeled, rather elongated but not imbricating; belly scales larger, smooth, sharply keeled and strongly imbricating, the keels forming lines.

Limbs and digits: - all scales on limbs strongly keeled; supradigital scales with multiple keels; subdigital lamellae 28-31.

Tail: - tail whorl with 4 dorsal and 3 ventral scales; all scales sharply keeled; male with enlarged postanal scales.

Colour: - General colour brown, no marked colour change; lighter brown stripe down centre of back, darker brown dorsolaterally sometimes broken into oval markings; some mottling on limbs; transverse banding on tail; head lighter brown, dark speckling on lips and dark marking behind ear; scales as well as interstitial skin of fan vermilion, dark brown pigmentation extends from neck onto scales in centre of fan; belly opalescent; females and juveniles have dark lines on throat.

Dimensions: - Adult male, snout to vent 50-55 mm, tail ca. 100 mm; female, snout to vent 40 mm, tail ca. 80 mm.

Range: - (fig. 2) Confined to the western part of the island, this lizard is not known east of Trelawny and Manchester. Apparently generally distributed in Westmoreland, St. James and Hanover, it has been recorded in Trelawny as far east as Albert Town. It is common in St. Elizabeth west of the Black River, and there are records from Balaclava in eastern St. Elizabeth and Williamsfield in Manchester.

Recorded from: - M., Williamsfield; StE., Balaclava, Maggoty, Black River; W., Darliston, Bluefields, Sav-la-mar, Negril; H., Cash Hill, Pennycooke, Halfmoon Bay, Halfmoon Cay, Lances Bay, Lucea, Dolphin Pen; StJ., Bogue Is., Montego Bay, Lapland, Greenwood; T., Albert Town.

Discussion: - It is difficult to make out any pattern in the distribution of this lizard. It occurs in coastal areas and in the mountains, in rather dry areas and in areas of lush vegetation. It occurs in areas where all the other groups are represented and is very common where several other forms are also very common. It is therefore difficult to surmise what factors limit its eastward distribution. The suggestion that it is a later arrival now in process of colonizing the island from a western centre of introduction is perhaps correct. The similarity to the Cuban population may be construed as supporting the suggestion that it has arrived recently. Should the Jamaican specimens be found to merit separate nomenclatural recognition, Gosse's name *catenata* is available (type in British Museum examined); happily it is associated with a precise locality.

A brief visit to Havana (Underwood) afforded an opportunity to see Cuban *sagrei* in life. In general colouration they agree with Jamaican specimens, however the fan does differ somewhat in that the ground colour is burnt sienna, sprinkled with straw yellow scales and with a narrow yellow margin. Grant (1940, p. 46) notes some differences between the squamation of Jamaican *sagrei* and the description of Cuban *sagrei* by Barbour and Ramsden (1919, p. 142). In general, the eight specimens collected in Havana agree better with Jamaican material than with Barbour and Ramsden's description: the ridges on the snout are separated by 2 or 3 scales halfway between the eye and the nostril; the scales near the end of the snout bear multiple keels; the supraorbital semicircles are separated by 1 scale or in contact; the interparietal is nearly as large as the ear opening and separated from the supraorbital semicircles by 2 or 3 (1 specimen 4) scales. The Havana specimens do not agree with Barbour and Ramsden's statement that 'the lower loreal row ... passes backwards below the eye in contact with the supralabials so that there is no

true subocular semicircle". The posterior lower loreal is wedged between a large subocular and a supralabial; our Jamaican specimens agree in this respect.

ANOLIS GARMANI Stejneger

Anolis garmani Stejneger (1899). *Amer. Nat.*, 33 : 601. No type; type locality Jamaica.

Dactyloa edwardsii [non Griffith], Gosse (1851). *Naturalist's Sojourn in Jamaica* : 76

Anolis edwardsii [non Griffith], Boulenger (1885). *Cat. Liz. Brit. Mus.*, 2 : 24

Anolis garmani, Grant (1940). *Bull. Inst. Jamaica, Sci. Ser.*, 1 : 83.

Description: - The largest Jamaican anole, with a large head and long tail.

Head: - a) scales of the supraorbital semicircles sharply keeled; semicircles separated by 2 or 3 scales b) posterior frontal usually much shorter than first orbital; frontal area flat with small, strongly keeled, rugose scales c) no internarial eminence d) supraocular and subocular scales sharply keeled, rugose e) canthal ridge very distinct as far as nostril f) anterior subocular separated from canthal ridge by one scale g) 6-8 labials h) 5-6 rows of loreals i) interparietal half or slightly less than half the size of supraorbital disc, oval, separated from the supraorbital semicircles by 2-4 scales j) ear opening moderate, oval.

Fan: - large, in male only; periphery with close-set swollen imbricating scales, somewhat elongated; centre with rather close-set swollen round keel-less scales.

Trunk: - a distinct crest in the males of high, pointed mid-dorsal scales; crest vestigial in females (one or more lines of mid-dorsal scales almost always distinctly elongate, often with raised keels, especially in the nuchal region); dorsal and lateral scales swollen and keeled, not or but little smaller than ventrals; belly scales not or very slightly keeled, smooth, non-imbricating, arranged in transverse rows which tend to be continued onto the sides.

Limbs and digits: - larger dorsal scales of limbs smooth, keeled; smaller ventral scales smooth, keel-less; supradigital scales usually smooth, rarely vaguely keeled or wrinkled; subdigital lamellae 38-45.

Tail: - tail whorl with 3 dorsal and 3 ventral scales; dorsal scales with strongly raised keels continuing the crest of the back; male with slightly enlarged postanal scales.

Colour: - General colour bright emerald-green; striking colour changes; in the intermediate phase oblique light bars on the sides, sometimes with spots rather than bars; dark phase a uniform black; fan orange with a greenish yellow border.

Dimensions: - Adult male, snout to vent up to ca. 120 mm, tail ca. 250 mm; female, snout to vent ca. 80 mm, tail ca. 160 mm.

Range: - This form probably ranges all over the island in suitable localities. At lower levels it is found only where large trees or clumps of bamboo offer good shade, never in low-lying scrub country. Clydesdale and St. Peters in the upper Yallahs valley appear to be the highest records for the species (ca. 3500 ft.). it has

not been recorded from Portland Point or the Hellshire Hills. Of the Jamaican anoles this species appears to be the most localized in its occurrence. In six years it has never been seen at Mona although known to occur to north and south within a mile radius. In regions where it does occur it usually appears to be rather sparsely distributed. It may be fairly numerous in the mountain forests at moderate altitudes. On the other hand in some places it may be seen near the sea shore.

Recorded from: - StT., Corn Puss Gap, Cedar Valley; KStA., Kingston, Long Mtn., Hope Gardens, Papine, Constant Spring, Newcastle, Chestervale, Clydesdale, St. Peters; C., Bull Head Mtn., Spaldings; StC., Mt. Diablo; M., Mandeville, Christiana, Williamsfield; StE., Malvern, Pepper, Springfield, Accompong, 5 mi. up Black River, Happy Grove, Balaclava; W., Sav-la-mar, Negril; StJ., Montego Bay, Catadupa, Greenwood, Lapland; T., Windsor, Stewart Town; StA., Ocho Rios, Eltham, Mt. Zion; StM., Highgate, Castleton; P., Grays Inn, Buff Bay, St. Margarets Bay, Port Antonio, 3 km W Ecclesdown.

Discussion: - This form was named by Stejneger without mention of any particular specimens and with locality no more precise than "Jamaica" and with an indication so meagre that it is only the distinctiveness of the lizard which makes it recognizable.

This large lizard will eat other lizards as well as insects. A large specimen has jaws sufficiently powerful to inflict a painful bite.

ANOLIS GRAHAMI group

This group includes three forms with several features in common; all have a voice and squeak when handled; the frontal area is only slightly or not at all depressed; there is always some mottling in intermediate colour phases; there is commonly some more or less well developed blue colouring around the base of the tail; the pericardium is deeply pigmented.

It is of interest that this group includes two sympatric stocks. The range of *opalinus* is largely coextensive with the ranges of the two forms of *grahami*. It is possible that *opalinus* has been derived from *grahami* stock in Jamaica and has graduated from an allopatric to a sympatric relation with the latter. In this sibling pair of species there is a marked difference in size as has often been noted for sibling pairs in other groups (fig. 3).

For this group we record only localities supported by specimens which we have personally examined.

ANOLIS OPALINUS Gosse

Anolis opalinus Gosse (1850). *Ann. Mag. Nat. Hist.*, Ser. 2, 6 : 345. Supposed type British Museum 47.12.27.43 = 1946.8.5.50, type locality Bluefields, Westmoreland. Coll. P.H. Gosse.

Anolis grahami, Boulenger [partim] (1885). *Cat. Liz. Brit. Mus.*, 2 : 32.

Anolis flabellatus Cope (1894). *Proc. Acad. Nat. Sci. Phila.*, 1894 : 430.

Anolis opalinus, Grant (1940). *Bull. Inst. Jamaica, Sci. Ser.*, 1 : 92.

Description: – The smallest Jamaican anole.

Head: – a) scales of supraorbital semicircle very bluntly keeled; semicircles separated by 1 (rarely 2) scale or in contact; posterior frontal shorter than first orbital b) frontal area nearly flat or but slightly depressed, with small slightly rugose and slightly keeled scales. c) no internarial eminence d) supraocular and subocular scales weakly and bluntly keeled e) canthal ridge rather blunt f) anterior subocular scale in contact with canthal ridge or separated by 1 scale g) 6–7 upper, 5–6 lower labials h) 4–5 loreal rows i) interparietal about half the size of the supraocular disc; separated from the supraorbital semicircles by 2–4 scales j) ear opening large, round.

Fan: – moderate, in male only; periphery with close set, swollen, keel-less scales; centre with few larger smooth swollen keel-less scales.

Trunk: – an erectile nuchal and dorsal fold; mid-dorsal scales not differentiated; dorsal and lateral scales granular, keel-less, not imbricating; belly scales larger, smooth, flat and quite keel-less, very slightly imbricating.

Limbs and digits: – large scales on upper side of limbs keeled, smaller ventral scales keel-less, rather sharp transition on anterior face of limb; supradigital scales with multiple keels; subdigital lamellae 31–38.

Tail: – tail whorl with 3 dorsal and 3 ventral scales; scales beneath base of tail quite smooth, flat and keel-less except for one or two immediately before the first autotomy septum; male with slightly enlarged postanal scales.

Colour: – General body colour ranges from olive to grey; colour change not marked; mottled on the back; a light stripe on the side which commonly starts from the lips, runs back over the shoulder along the flank; generally a paired marking on the sacrum; underside of head of juveniles and females with dark streaks; commonly a little blue around the base of the tail; fan dark orange with a yellow border and yellow centre; belly scales opalescent.

Dimensions: – Adult male, snout to vent 47 mm, tail ca. 80 mm; female, snout to vent 40 mm, tail ca. 60 mm.

Range: – This species occurs all over the island from sea level to at least 5000 ft. in the mountains. In some places they are very common on the seashore trees (Christmas River), in other places very common in the mountains at 4000 feet (Catherines Peak). The highest definite records appear to be Morces Gap and near the top of Catherines Peak, both about 5000 feet. No doubt the species ranges somewhat higher than this on some of the Blue Mountain peaks. It has not been recorded from Port Henderson Hill (4 visits) or Cabaritta Island (2 visits).

Recorded from: – St.T., Retreat Beach, 2½ km N Whitehall, Cuña Cuña, Lyssons Beach, Morant Bay, E bank Morant River, Beacon Hill, Pleasant Hill, Bath, Port Morant, Emerald I., Morant Point; KStA., Belle Vue, Penlyne Castle, Whitfield

Hall, Guava Ridge, Newcastle, Chestervale, Clydesdale, Papine, Mona, Hope Gardens; C., Portland Point, Spaldings, Bull Head Mtn.; M., Mandeville, Fairfield; StC., Salt I. Pond, 1¼ km N Mango Grove, Juan de Bolas; StE., Elim, Pedro, Maggotty, Balaclava, Black River, Black River Swamp (18°4'N77°49'W), Happy Grove, Springfield; W., Newmarket, Darliston, Bluefields, Sav-la-mar, Negril, Homers Cove, Old Hope, Lochiel; H. Haughton Court; StJ., Greenwood; StM., Frankfort, Castleton, Highgate; P., Enfield, 8 km SW Buff Bay, Port Antonio, Priestmans River, Christmas River, Moore Town, 1 km N Manchioneal, Ecclesdown, 3 km W Ecclesdown, Bath, Corn Puss Gap trail.

Discussion: – This form is, in some localities, the most abundant of the Jamaican anoles. Notwithstanding Grant's opinion to the contrary, there can be no reasonable doubt that it is closely related to *grahami* and is in fact probably derived from it. It may be suggested that perhaps *opalinus* first differentiated in some peripheral part of the range of *grahami*, possibly in the mountains, and then reached a level of reproductive isolation and ecological differentiation such that, coming to occupy a new place in the biological economy, it invaded the territory of the parent form. In this connection it is interesting to note that on Cabaritta Island in Port Maria Bay, where *grahami* and *merope* were found to be abundant, no trace of *opalinus* was seen. Perhaps this island was severed from the mainland of Jamaica before the arrival of *opalinus* in this area.

Nomenclature: – The specimen listed by Boulenger (1885) as the type of *A. opalinus* Gosse and still so recorded by the British Museum appears to be a juvenile specimen of *A. grahami* Gray. The century-old specimen lacks all trace of a light line on the side, and indeed all trace of pattern. There are two scales between the supraorbital semicircles; the interparietal scale is about as large as the supraorbital disc and separated from the supraorbital semicircles by 5 scales on each side. Each of these features is characteristic of *grahami* Gray and not of the species here called *opalinus*; two scales between the supraorbital semicircles are present only rarely in *opalinus*. There is however, as Grant has already suggested, good reason to doubt that the British Museum specimen is correctly labelled as the Gosse type of *opalinus*. Gosse, although he mentions specimens in the British Museum, did not explicitly designate these as the types of *opalinus*. Moreover his admirable description, entirely adequate for the recognition of specimens in the field, was apparently of a living specimen. There is thus no assurance that the specimen which Gosse described was included in the sample series which he sent to the British Museum. There is no Gosse label with the specimen, the label which it does bear dating only from 1936. Until quite recently the British Museum did not tag even their types, and the only labels were those on the bottles. This practice has, in the case of *grahami* and *iodurus*, led to an unresolvable confusion of two series. In the present case it may have permitted substitution of another specimen for the true Gosse type – if Gosse ever intended to designate any specimen as a type in the modern sense.

The reality of *opalinus* as a species is not in question. All who have dealt with Jamaican anoles in the field recognize its validity and the appositeness of Gosse's description. The question is thus purely a nomenclatural one and hinges upon the acceptance or rejection of the British Museum specimens as the type of the species.

Cope, who at first correctly determined *opalinus* in a collection of Jamaican anoles solely from Gosse's description, never again referred to the name after seeing the British Museum collections. Indeed, Cope redescribed the species under the name *flabellatus* in 1894 (it is under this name that the British Museum at present records the specimens). We, however, reject the supposed British Museum type of *opalinus* because there is no evidence that Gosse ever regarded it as the type, because he quite clearly did not designate it as such, and because it does not correspond to the description. In our view *A. opalinus* is adequately founded on the original description (1850) supplemented by a further account in the following year (1851, p. 217). *A. flabellatus* Cope is therefore a synonym.

ANOLIS GRAHAMI GRAHAM Gray

Anolis grahami Gray (1845). *Cat. Liz. Brit. Mus.*, : 274.

Types ♀ & juv. 1936.12.3.101 = 1946.8.5.49 & 1936.12.3.104-106 = 1946.8.28.89-91.

Type locality unknown. Coll. Sir J. McGregor.

Anolis punctatus Gray [non Daudin] (1840). *Ann. Mag. Nat. Hist.*, 5 : 113.

Anolis iodurus Gosse (1850). *Ann. Mag. Nat. Hist.*, Ser. 2., 6 : 344. Types in British Museum 47.12.27.42,44,45,47. Type locality Bluefields, Westmoreland. Coll. P.H. Gosse.

Anolis punctatissimus Hallowell (1856). *Proc. Acad. Nat. Sci. Phila.*, : 225.

Anolis grahami, Boulenger (1885). *Cat. Liz. Brit. Mus.*, 2 : 32.

Anolis grahami iodurus, Grant (1940). *Bull. Inst. Jamaica, Sci. Ser.*, 1 : 86.

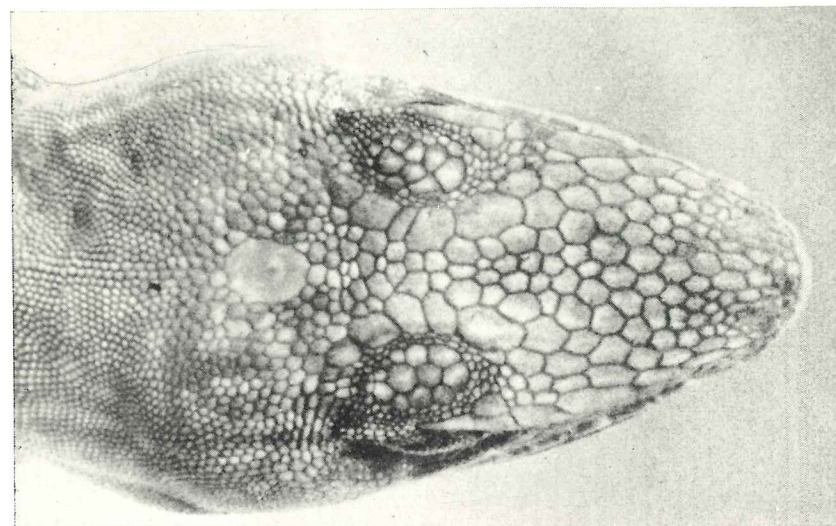
Description: - (fig. 4 & Pl. Ia) A plump anole of moderate size.

Head: - a) scales of supraorbital semicircles bluntly keeled, the rows separated by 2 (rarely 1) scales; posterior frontal shorter than first orbital b) frontal area flat with small, rugose, sharply keeled scales c) no internarial eminence d) supraocular and subocular scales distinctly keeled, rather rugose e) canthal ridge sharp all the way to the snout f) anterior subocular separated from canthal ridge by 1 scale g) 6-8 upper, 6-7 lower labials h) 5 rows of loreals, rarely 4 or 6 i) interparietal as large or nearly as large as the supraocular disc, rounded or polygonal, separated from the supraorbital semicircles by 3-5 scales, generally 4 j) ear opening rather small, oval.

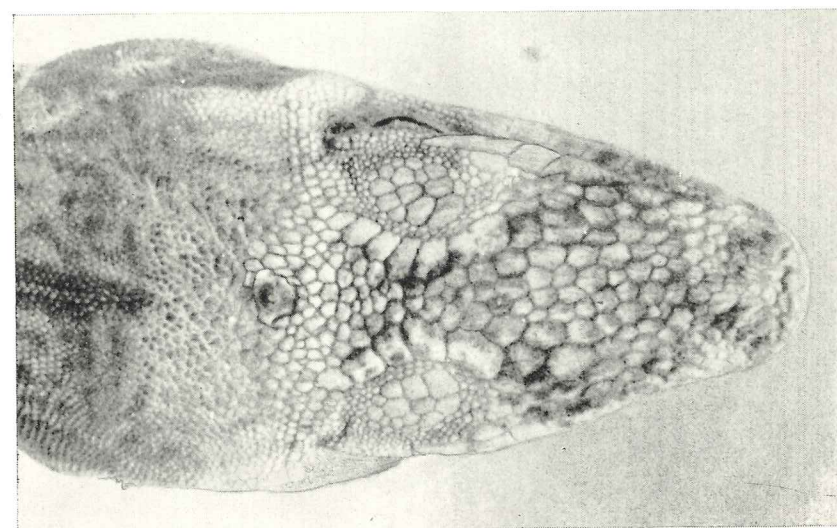
Fan: - anterior scales slightly swollen, keel-less, imbricating; scales in centre swollen, keel-less, in widely spaced rows.

Trunk: - erectile nuchal and body fold in male; 2 or more rows of mid-dorsal scales somewhat enlarged, not different in shape from lateral scales, not elongate;

PLATE I

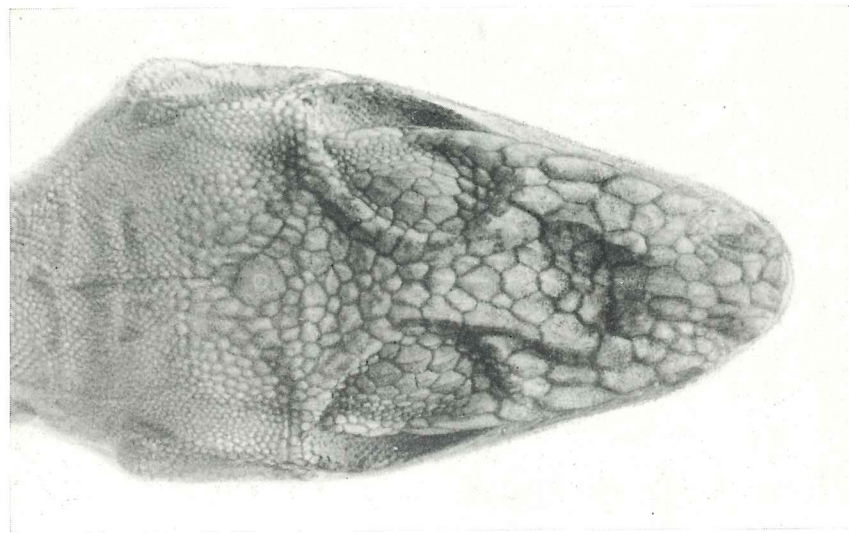


a. Dorsal view of head of *Anolis grahami grahami* (Bull. Head Mtn., Cn.), scale outlines retouched.

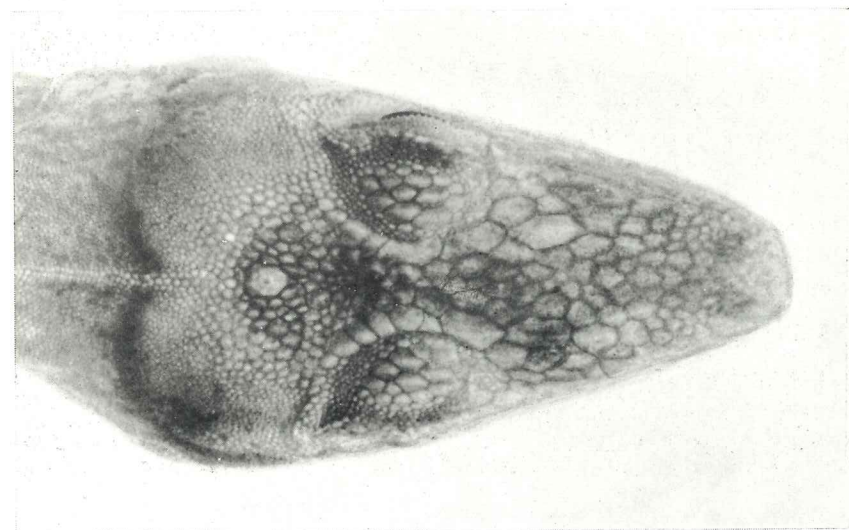


b. Dorsal view of head of *Anolis grahami aquarum* (Type). Scale outlines retouched.

PLATE II

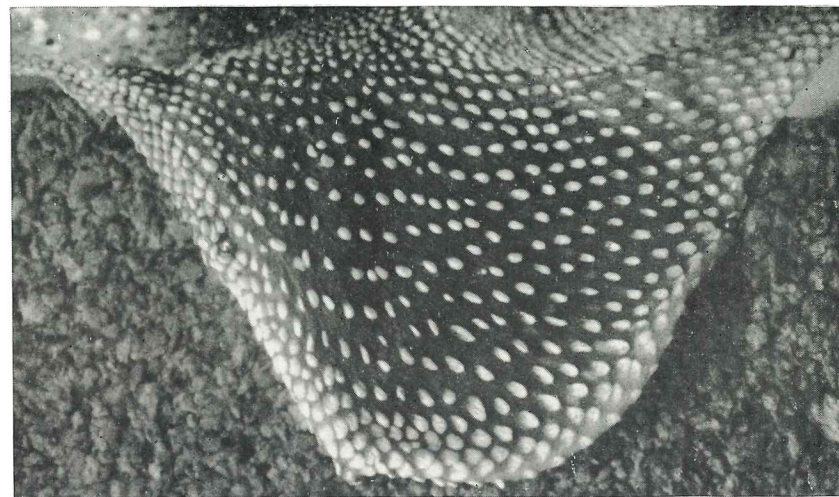


a. Dorsal view of head of *Anolis reconditus* (Type). Scale outlines retouched.



b. Dorsal view of head of *Anolis lineatopus neckeri* (Negril, W.) Scale outlines retouched.

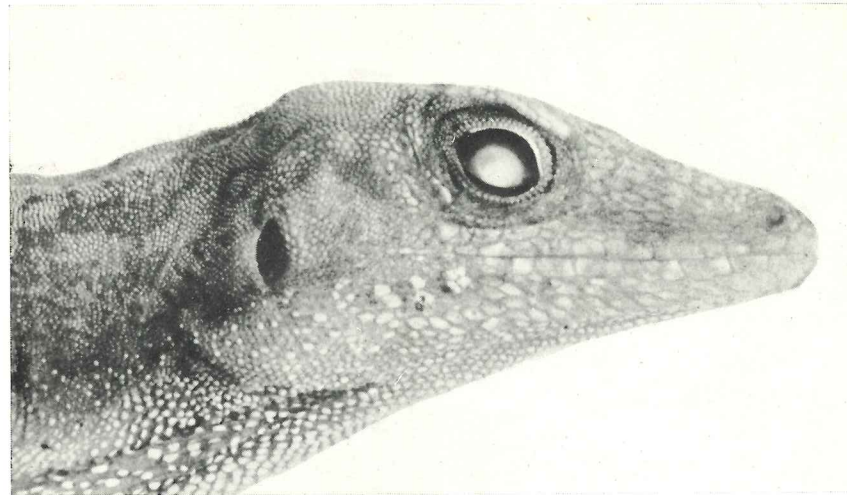
PLATE III



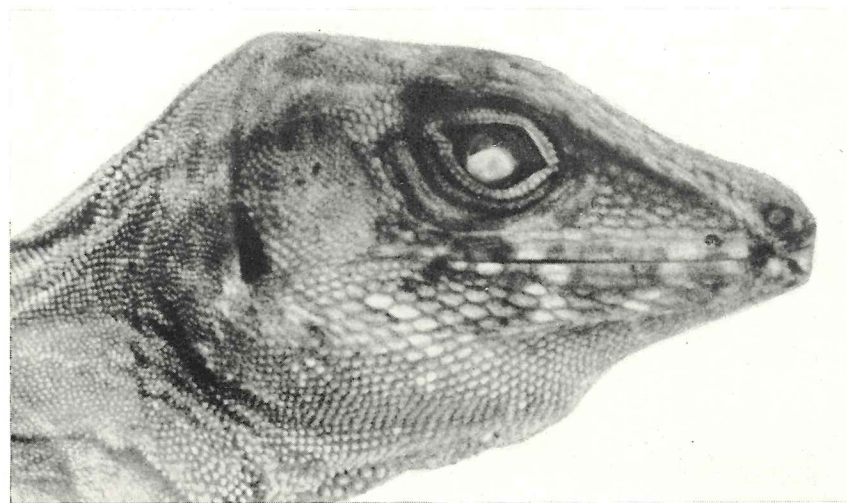
a. Throat fan of *Anolis lineatopus ahenobarbus* (Type). Unretouched.



b. Throat fan of *Anolis lineatopus lineatopus* (Kingston). Unretouched.



a Lateral view of head of *Anolis lineatopus ahenobarbus* (Type). Scale outlines retouched.



b. Lateral view of head of *Anolis lineatopus ahenobarbus* (John Crow Mtns., P.) Scale outlines retouched.

all dorsal and lateral scales swollen (granular), barely if at all keeled; belly scales larger, usually quite without keels, imbricating.

Limbs and digits: - scales on dorsal and anterior surface of limbs lightly keeled; supradigital scales usually keeled; subdigital lamellae 33-38 (mode 36).

Tail: - tail whorl with 4 dorsal and 3 ventral scales; all scales well keeled; male with slightly enlarged postanal scales.

Colour: - general colour green, pronounced colour change; head bluish-green, back yellowish-green, sides pronounced yellowish-green sometimes turning khaki, hind legs and rump blue-green, base of tail purple grading into cinnamon distally; interstitial skin of fan deep orange with narrow yellow border, fan scales blue-green; in dark phase turns nearly black including fan scales; female less brightly coloured, generally chalky green with a broad light stripe running down the back; several darker transverse bands on back and sacrum, constricted mid-dorsally.

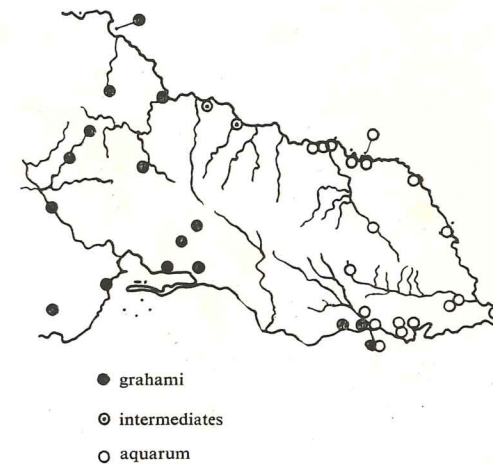


Fig. 3. Map showing records of *Anolis grahami grahami* and *Anolis grahami aquarum* in eastern Jamaica.

This description applies to specimens from dry south side localities. In Hanover and Westmoreland the mottling on the head is very pronounced and extends onto the body as fine light speckling. In a series from Highgate, St. Mary, the males show blue-grey under the head, and a strongly yellow belly. They are commonly seen in an intermediate colour phase in which transverse hour-glass markings are conspicuous. A specimen from Alligator Pond had light blue extending from the base of the tail up the back onto the head. Intergrades with *aquarum* are discussed below.

Range: - (fig. 3). For some time the range of this lizard has been rendered uncertain owing to the confusion involving members of this group. Grant (1940) points

out that many of the reported localities show either erroneous identification or data. This form extends along the south side from Negril to the west bank of the Morant River. Along the north side it is known from Hanover to St. Mary. Intergrades occur from St. Mary into Portland; these are discussed below.

There are not many records for this form above 2000 feet elevation. The Bull Head Mountain specimens were taken at 2700 feet; there is a sight record (Underwood) at about 2500 feet on the road to Newcastle; Spaldings is at about 2700 feet. Recorded from: - St T., W bank Morant River, E bank Morant River, Rozelle Falls; KSta., Mona, Hope Gardens, 4 km S of Castleton, Kingston; StC., Salt I. Pond, Watermount, 16 km W Spanish Town, Linstead, Ewarton, Port Henderson Hill; C., Portland Point, Bull Head Mtn., Happy Grove; Spaldings, M., Williamsfield, Alligator Pond, Mandeville; StE., Elim, Balaclava, Bogue, Pedro, Maggotty, Malvern, Accompong, Springfield, Black River, Black River Swamp (18°4'N 77°49'E and 18°3'N 77°50'E); W., Torrington, Sav-la-mar, Negril, Darliston; StJ., Spot Valley, Montego Bay, Greenwood; T., Windsor, Salt Marsh, Albert Town, Martha Brae; StA., Eaton Hall, Antrim, Roaring River, Runaway Bay; StM., Port Maria, Highgate, Cabaritta I., Agualta Vale.

Anolis grahami has been introduced into Bermuda. During an intransit visit to Bermuda (Underwood) these lizards were seen to be common everywhere and, in the field, were indistinguishable in general appearance from Kingston examples. Likewise, four specimens collected could not be distinguished from Kingston specimens in either colour pattern or squamation.

Nomenclature: - *Anolis stenodactylus* Gray was regarded as unrecognizable by Grant (1940, p. 140), he nevertheless placed it as a synonym of *A. grahami iodurus* (p. 87). *A. stenodactylus* had already been placed by Boulenger in the synonymy of *A. richardii*, a form from the Lesser Antilles. Examination of the type of *A. stenodactylus* at the British Museum confirms Boulenger's opinion.

In the British Museum collection the type series of *A. grahami* Gray and *A. iodurus* Gosse are now inseparably mixed. This in itself sufficiently demonstrates the identity of these two forms. In spite of its appropriateness Gosse's name must therefore be rejected as a junior synonym. The use of the name *grahami* by Barbour and by Grant for the eastern form appears to be due to the fact that Gray's otherwise extremely inadequate description did mention keeling of the belly scales. The type specimens clearly show that the keeling is not of the character (sharp and in lines) found in the eastern specimens. The presence of faint keeling on the belly scales further restricts the area from which the *grahami* types may have come. The same is true of *A. punctatissimus* Hallowell. Examination of the type specimen in the Philadelphia Academy of Natural Sciences shows that it is a specimen of *grahami* with slightly keeled belly scales.

Discussion: - It is worth noting that this form is not separable from *opalinus* by any hard and fast scale characters. At Mona, for example, it is impossible to differentiate them by squamation; colouration and adult size here afford the only

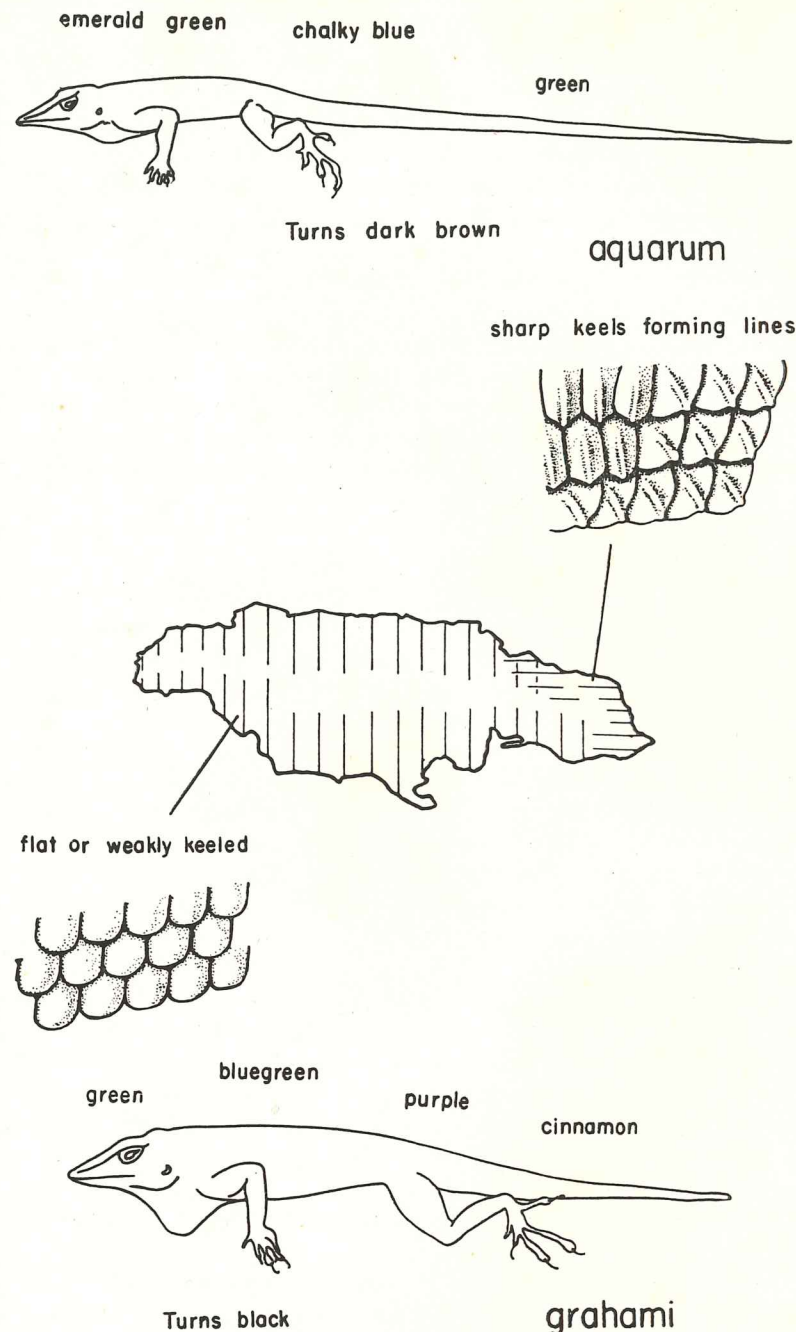


Fig. 4. Sketch showing distinction between subspecies of *Anolis grahami*.

characters. In the north-side and west end populations, the belly scales are commonly lightly keeled thus making the discrimination easier.

ANOLIS GRAHAMIA AQUARUM subsp. nov.

Anolis grahami grahami [non Gray], Grant (1940). *Bull. Inst. Jamaica, Sci. Ser.* Description: – (figs. 4 & Pl. 1b) short diagnosis given on p. 11) Differs typically from *grahami* in that the interparietal scale is small in size, about half the size of the supraocular disc; separated from the supraorbital semicircles by 4–6, generally 5 scales; head scales keeled but less rugose; supraorbital semicircles separated by 2 scales, rarely 3; labials 6–9 with a higher average; tail whorls with 3–4 dorsal, 3 ventral scales; subdigital lamellae 32–41 (mode 40), a distinctly higher average; belly scales strongly keeled with tendency to form lines; scales on anterior face of thigh bear pronounced keels.

Colour: – Differs consistently from *grahami* in colour pattern which is less complex; whole of body bright emerald-green, generally some mottling dorsally, a little blue around the base of the tail usually present; fan yellow-orange extending to the margin; in intermediate colour phase brown with fine light speckling over head, trunk and limbs; in dark phase turns a dark brown; females duller with a buff dorsal stripe which is most pronounced on the lumbar and sacral regions and reduced to light speckling on the neck, transverse hourglass markings usually visible. Dimensions: – Adult male, snout to vent 55 mm; a smaller lizard than *grahami*. Type: Adult male B.M.N.H. 1954.1.2.61 Botanical Gardens, Bath, St. Thomas (17° 57'N 76° 21'W). Coll. G. Underwood; 2 paratypes, M.C.Z. 52319 (+1), same data. Range: – (fig. 3) The same remarks as to confusion of identification and of range apply to this form as to *grahami*. Contrary to Grant's view that it "is not found at either end of the island" it appears to be confined to the eastern parts of Portland and St. Thomas. In St. Thomas, where it does not intergrade with *grahami*, it is known as far west as the Morant River, with the nominate subspecies known from the far bank of that river.

In Portland, where it does intergrade with *grahami*, specimens that are typical *aquarum* as regards colouration occur as far west as St. Margarets Bay (see discussion). It is also present in the Rio Grande valley but has not been recorded from the John Crow Mountains.

Other material examined from: – P., St. Margarets Bay (1), Port Antonio (1), Downers Bluff (2), Woods Island (4), Moore Town (1), Soldiers Bay (4), Boston Bay (2), Fair Prospect (1), Christmas River (1); St. T., Golden Grove (1), near Pleasant Hill (4), W side Port Morant (2), Johns Pen (2), 1½ km N Whitehall (1), 1½ km N Morant Bay (1), Morant Bay (1), E bank Morant River (1).

Discussion: – The relations of this form with *grahami* present a situation of great interest. On the south coast there are no indications of intergradation between the two forms, and on present data the bed of the Morant River indicates the boundary

between them. On six occasions typical *g. grahami* has been taken on the west bank of the Morant River and typical *g. aquarum* on the east bank. On one occasion a typical *g. grahami* was taken on the east bank of the river within a few yards of spots in which *g. aquarum* has been taken. On the north side intergrades occur in western Portland. The specimens from Downers Bluff and St. Margarets Bay are intermediate in squamation although typical in colouration. In Buff Bay individuals were obtained intermediate in colouration. They were yellow-green with no trace of purple on the tail, and could turn only dark brown; two specimens kept for several weeks never showed a colour phase matching either of the named forms. All the specimens from Buff Bay (3) and Woodstock (5) (2 km NW Buff Bay) were of this type. However at Windsor Castle (6 km. NW) the 5 specimens collected were variable, ranging from good intermediates to one indistinguishable from Kingston specimens in colouration. The colour-intermediate specimens were not, however, intermediate in squamation. On scale characters they would all be assignable to *grahami* without reservations. Belly scales ranged from keel-less to faintly keeled (the majority) to moderately keeled (one Windsor Castle specimen). In all, the interparietal scale was as large as or nearly as large as the supraocular disc. The subdigital lamella counts averaged about 35, maximum 37. On Cabaritta Island the lizards are more yellow-green than typical *grahami*; in squamation, however, they are typical *grahami*.

There thus appears to be a ring of races involving only two forms and the whole can be surveyed in a day's drive along the main coast road. There are not as yet many records for the *grahami* group in western Portland, and it is possible that there is already effective isolation between the two populations but with extensive evidence of recent differentiation. The data at present available suggest that the specimens intermediate in squamation are typical *aquarum* in colouration and conversely that the specimens intermediate in colouration are typical *grahami* in squamation: thus the areas of intergradation for these two sets of characters are in quite different places.

ANOLIS LINEATOPUS GROUP

THIS group is remarkable for the fact that within the island mainland it is represented by five known geographical forms. The members of the group have the following features in common: the supraorbital semicircles bear pronounced ridges which continue forward onto the snout enclosing a pronounced frontal depression; the pericardium is unpigmented or with only a few melanophores; the fan is orange in the centre often with a paler margin; there is some brick red under the tail.

Grant's comment in regard to this group is quite pertinent: "*lineatopus* which has speciated even more than *grahami* has heretofore been considered a restricted form without subspecies. It is a puzzle to know to which species the variants which swarm all over the island have been assigned by various collectors if the single recognized species has been restricted to the vicinity of Kingston". As with the



Fig. 5. Map showing records of members of *Anolis lineatopus* group in Jamaica.

grahami group we record only those localities based on specimens which we have personally examined (fig. 5).

ANOLIS LINEATOPUS LINEATOPUS Gray

Anolis lineatopus Gray (1840). *Ann. Mag. Nat. Hist.*, 5 : 113.

Type ♀ juv. in British Museum 1936.12.3.92 = 1946.8.12.61, locality unknown. Coll. Sir J. McGregor.

Anolis maculatus Gray (1840). *Ann. Mag. Nat. Hist.*, 5 : 113.

Types ♂♂ in British Museum 1936.12.3.94 = 1946.8.29.14 & 1936.12.3.93 = 1946.8.12.62, locality unknown. Coll. Sir. J. McGregor.

Anolis lineatopus, Boulenger (1885). *Cat. Liz. Brit. Mus.*, 2 : 39.

Anolis lineatopus lineatopus, Grant (1940). *Bull. Inst. Jamaica, Sci. Ser.*, 1 : 89.

Anolis lineatopus lynni Grant (1940). *Jamaica Today*: 185.

Type Lynn coll. L. 13, type locality Chestervale, St. Andrew. Coll. W.G. Lynn, 19.vi.36.

Anolis lineatopus coxi Grant (1940). *Jamaica Today*: 185

Type M.C.Z. 45079, type locality Portland Ridge, Clarendon. Coll. C. Grant, 18.iv.37.

Description: - (figs. 6 & Pl. IIb; applicable to material from the Kingston neighbourhood). A fairly stout anole, with a broad head.

Head: - a) scales of the supraorbital semicircles sharply keeled; ridges prominent, continuing forwards onto snout nearly as far as nares; semicircles semiparated by 2, rarely 1 or 3 scales; posterior frontal as long as or shorter than first orbital b) frontal area showing pronounced depression with about 12-20 smooth sharply keeled scales c) moderate internarial eminence d) supraocular and subocular scales sharply keeled e) canthal ridge very prominent extending right to nostril f) anterior subocular separated from canthal ridge by 2 scales, sometimes 3 or 4, rarely 1 on both sides g) upper and lower labials 6-7, rarely 8, rarely 5 on one side only h) 6 (rarely 5 or 7) rows of loreals i) interparietal small, not usually more than half the size of the supraorbital disc, separated from the supraorbital semicircles by 3-5 scales j) ear opening moderate, vertically oval.

Fan: - scales on anterior margin flat, keeled and imbricating; other fan scales in widely spaced rows, slightly keeled, flat, thin.

Trunk: - erectile fold from occiput to sacrum; most prominent in nuchal region; dorsal and lateral scales small, broad, oval, mildly swollen, keeled; several mid-dorsal rows moderately enlarged; scales on shoulder flat, keeled, fully imbricating; scales on belly longer than broad, slightly swollen, distinctly keeled, moderately imbricating.

Limbs and digits: - fine keeled scales dorsally on hind limbs; much larger, flat sharply keeled, imbricating scales on anterior face; medium-sized, slightly keeled scales ventrally, uniform in size from groin to knee; supradigital scales with sharp multiple keels; subdigital lamellae 29-34.

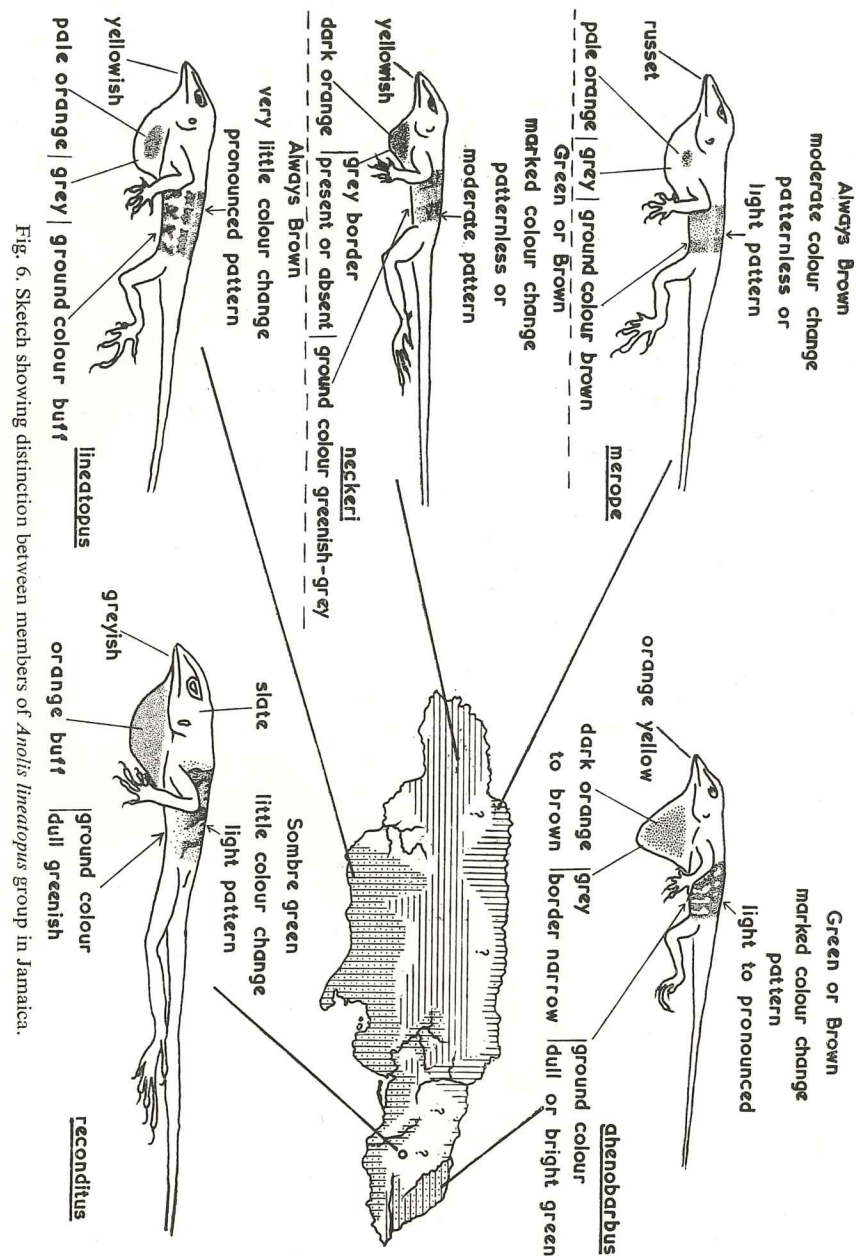


Fig. 6. Sketch showing distinction between members of *Anolis lineatopus* group in Jamaica.

Tail: - tail whorl with 4 dorsal and 3 ventral scales; all tail scales sharply keeled. Colour: - General colour brown, little colour change possible and no change of pattern; male, head uniform brown above; around eye sandy or tending to russet; white spots from labials onto sides of throat, sometimes indistinct on lips; occasionally light spotting or mottling on nape; interparietal conspicuously paler than surrounding scales; chin yellowish in centre, flanked by grey-brown mottling; fan general appearance orange in centre with yellow border (orange to margin in a single specimen taken at Mona); interstitial skin orange in centre with pale yellow border (rarely orange to margin); scales overall yellowish; dorsum with broad light mid-dorsal stripe flanked by 6-9 dark brown transverse bands, 5-7 on trunk, 1 or 2 on sacrum; bands commonly with light margins, sometimes containing light spots; bands sometimes faint or constricted mid-dorsally; bands descend sides and disintegrate into mottling ventrolaterally; bands wholly or partially interrupted by 2 light longitudinal lines, a broad line from shoulder to groin, a narrower line dorsolaterally, forming a gridiron pattern; some joining of adjacent bands dorsally and/or ventrolaterally; tail commonly with transverse hour-glass markings on proximal half, less regular distally; belly yellow-grey with more or less faint mottling laterally; underside of tail likewise proximally, variegated distally, sometimes with groups of brick red scales; limbs with conspicuous transverse bands; transverse markings on digits; underside of hindlimbs usually speckled or mottled; female similar to male but head commonly russet; frequently dark lines on throat; dorsum variable, broad light mid-dorsal stripe flanked by dark brown which may be uniform or speckled or indistinctly organised in transverse bands, several dark hour-glass transverse bands may cross dorsal stripe; lateral and usually dorsolateral light lines clearly evident; belly opalescent.

Range: - (fig. 5) This form extends along the south side of the island but not as Grant states, "from the eastern to the western ends of the island". In St. Elizabeth it is recorded from the east side of the Black River. It is believed to overlap *neckeri* at Mandeville. It appears to meet *neckeri* on the south edge of the Juan de Bolas ridge in St. Catherine, and extends up the Rio Cobre gorge into the inland basin of the river. On the margin of the Rio Cobre basin it meets *merope* between Riversdale and the Troja gap. North of Kingston it probably meets *neckeri* at Constant Spring. Along the coast of St. Thomas it is known as far as Port Morant. Inland it occupies the Yallahs River drainage and just extends into the western margin of the Morant River drainage at Cedar Valley. It is interesting to find this form along the north coast in western Portland. It ranges right up the upper reaches of the Yallahs valley (Penlyne Castle - Clydesdale - Chestervale - Silver Hill, ca. 3500 ft.). It could perhaps have reached the north coast through the Silver Hill Gap; the present climatic conditions in the Buff Bay river valley are however such that it is unlikely that *lineatopus* now occurs there. The Stony Hill Gap represents another possible route to the north coast; *lineatopus* has not been found in the neighbourhood of the gap but *lineatopus*-like intermediate individuals are known in the

Wag Water valley. The lowest pass between north and south coasts is the Troja gap (less than 1000 feet elevation) which separates the Rio d'Oro tributary of the Rio Cobre from the Flint River tributary of the Wag Water River. At present however *merope* occupies the gap and the western side of the Wag Water basin. These records far exceed in elevation those from other parts of the range where Mandeville (2000 ft.), Mount Rosser (1500 ft.) and Malvern (2000 ft.) constitute the highest records. It is known at points along the north coast in the vicinity of Hope Bay; east of this it extends to Port Antonio, but the north shore situation is complicated by indications of intergrading, and will be discussed in a special section.

Recorded from: - StE., Balaclava, Pedro, Calabash Bay, Malvern; M., Mandeville, Williamsfield, Whitfield Turn, Alligator Pond; C., Braziletto Mtns., Salt I., Portland Ridge; StC., Mt. Rosser, Ewarton, Bog Walk, Riversdale, Pigeon I., Gt. Salt Pond, Salt I. Pond, Port Henderson Hill; KStA., Kingston, Mona, Hope Gardens, Long Mtn., E. Red Hills, Constant Spring, Lime Cay, Guava Ridge, Chestervale, Clydesdale, Silver Hill, Cane River Falls; StT., Richmond Vale, Cedar Valley, Rozelle Falls, W. bank Morant River, E bank Morant River, Morant Bay, Port Morant; P., Orange Bay, Hope Bay, Folly Point, W bank mouth of Rio Grande.

Nomenclature: - The type of *A. lineatopus* Gray is a juvenile female without locality data and therefore not readily assignable to a definite form within the general group. However, the specimen was collected by Sir J. McGregor who also collected the male types of *A. maculatus* Gray which display the variegated banding of the subspecies typified by the Kingston population. It is plausible therefore to assume that *A. lineatopus* is the female of *A. maculatus*, over which the first name has line priority. In any event the name *A. lineatopus* has been in unambiguous use for Kingston type animals since Boulenger's Catalogue in 1885; the decisions of the Copenhagen Congress, providing that a name so used for as long as fifty years shall be stringently conserved, quite effectively dispose of any difficulties which might arise from the lack of provenance and lack of distinctive characters of the female type.

Anolis lineatopus lynni Grant is based in two specimens collected by Dr. W. G. Lynn near Chestervale in the upper Yallahs Valley. They were distinguished from the typical form by their dark bellies. Seven more specimens from the vicinity of the type locality, however, show that this character is not general in the population; their bellies range from speckled to immaculate. The conclusion on the basis of two specimens that an area is inhabited by a significantly distinct population is in any case tenuous.

Anolis lineatopus coxi Grant was founded on a good series of specimens from Portland Point, an isolated peninsular body of limestone on the south coast. We have, after careful consideration, decided to relegate it to the synonymy of *A. lineatopus*.

Though the *coxi* population and the Kingston population do differ quite significantly, the variation encountered in the total geographical range of *A. lineatopus* is such as seriously to compromise the distinctness of the *coxi* population.

It is in any case distinct only statistically and is not a population of distinctive individuals. Furthermore, the differences, which define the *coxi* population cannot be related readily to the ecological conditions. Ecologically the Hellshire Hills are similar to Portland Ridge, but the *A. lineatopus* population of the Hellshire Hills is, in respect of the characters in which the Portland Ridge population differs, similar to that of Kingston. Portland Ridge was probably separated from the mainland by block faulting but subsequently rejoined by alluvial material. Such distinctive features as the population shows were perhaps gathered during the period of isolation. The range of variation of the mainland population, now that contact is reestablished, seems to indicate that there is free genetic mingling between *coxi* and the main population. We can envisage no factors tending to conserve such differences as do exist.

Discussion: - This form appears to be the south side counterpart of *merope*. In the parish of St. Catherine, on somewhat scanty evidence, the boundary appears to run between the moist woodland of the hills and the dry plains and foothills. Whilst overlapping with *neckeri* may occur at some points, it is probably not extensive anywhere. Around the town of Black River is a triangle of dry country similar to the Liguanea Plain. No representative of the *lineatopus* group is known to occur in this area. The Black River swamps appear to present a barrier to the westward dispersal of *A. lineatopus*. In eastern St. Thomas neither *A. lineatopus* nor any other representative of the group has been found, although *A. lineatopus* occurs in Port Morant to the east of the Morant River; the latter and other rivers have perhaps retarded its dispersal. This suggests that there has been dispersal from the central parishes of the south coast. Portland Ridge and the Hellshire and Port Henderson Hills have all been islands separated by block faulting and subsequently rejoined. Perhaps *lineatopus* differentiated on one of these as a form adapted to dry conditions.

The Yallahs Valley is very much in the rain-shadow of the high peak of the Blue Mountains and *lineatopus* does not in fact look out of place there. On the north coast it appears to overlap an original *neckeri merope ahenobarbus* meeting ground from Buff Bay to Hope Bay and the Rio Grande mouth. (See section "Areas of intermediate populations", pp. 42-44 for discussion of this situation).

A. l. lineatopus is variable in any one area, but in addition there is some measure of localization of varieties so that certain local populations are more or less recognizable. The Kingston and Portland Ridge populations for example represent fairly well the two extremes of head shape, broad and narrow respectively.

In Yallahs Valley specimens (Clydesdale, Chestervale, Silver Hill, Richmond Vale) the head is medium broad; the bands are pronounced and generally meet in the midline, the dorsolateral line is not evident. The western Portland specimens

are similar but the lateral line also is weak and the lips and side of the throat are more distinctly spotted. Specimens from Cedar Valley (on upper Negro River, western edge of Morant basin) are similar to the specimens from Yallahs Valley; the first two bands are especially pronounced.

On the coast, good typical *I. lineatopus* have been found as far east as Rozelle Falls. However about 5 km further east on the banks of the Morant River is a rather distinct population. Heads range in width from broad to medium. The bands are poorly defined and in many specimens are broken into a vermiculate pattern; the dorsolateral line is weakly developed, and the labials and sides of the throat show very weak indications of spotting.

The Port Henderson and Hellshire Hills specimens resemble Kingston specimens in colour pattern; their heads range in width from broad to medium. The Port Henderson Hill specimens sometimes show a grey cast.

The squamation of the undersurface of the thighs of the Hellshire Hills specimens is distinctive. The scales increase in size from groin to knee as their keels turn from longitudinal to transverse with relation to the femur.

A series from Salt Island (in Portland Bight near Portland Ridge) are of large average size; their heads range in width from broad to medium but are distinctly broader than in Portland Ridge specimens.

Specimens from the western part of the range, Manchester and St. Elizabeth are more or less typical in colouration. Their heads vary in width to quite as narrow as the Portland Ridge specimens.

The Portland Ridge (*coxi*) specimens have consistently narrow heads. The snout tapers evenly to the rostrum and there is no internarial eminence. The colour pattern is typical, in the light phase there is a tendency to grey; the orange of the fan tends to be centred on the anterior half.

ANOLIS LINEATOPUS MEROPE subsp. nov.

Anolis lineatopus neckeri [partim] Grant (1940). *Jamaica Today*: 155.

Description: – (fig. 6; short diagnosis given on p. 11). Differs from *lineatopus* in some points of squamation and in colour. In form it resembles Portland Ridge *lineatopus*.

Head: – a) supraorbital semicircles separated by 2, rarely 1, scales; posterior frontal shorter than first orbital b) frontal area shows pronounced depression with about 16–20 smooth sharp keeled scales. c) no internarial eminence f) anterior subocular separated from canthal ridge by 2 scales, rarely 1 or 3 g) 6–8 labials, average higher i) interparietal a little more than half the size of the supraocular disc, separated from supraorbital semicircles by 5–6 scales.

Fan: – scales on anterior margin swollen, keeled and imbricating; other fan scales in widely spaced rows, small, flattened, thin, faintly keeled.

Dorsum: – scales on shoulder flat, keeled, imbricating.

Limbs and digits: – fine keeled scales dorsally on hind limbs; much larger, flat keeled, imbricating scales on anterior face; medium-sized slightly keeled scales ventrally, uniform from groin to knee; subdigital lamellae 26–30.

Tail: – whorls with 3 or 4 dorsal and 3 ventral scales.

Colour: – Male; head uniform brown above, tending to russet; around eye russet or partly green; white spots from labials onto sides of throat, sometimes faint; interparietal pale; chin with more or less russet in centre; fan in general appearance pale with “washed out” orange centre; interstitial skin pale yellow with weak sprinkling of orange in centre, this may be very slight or rarely absent; scales very pale yellow; trunk, a patternless phase may occur; usually no indication of light mid-dorsal stripe; 4 or 5 brown transverse bands, 3 on trunk, 1 or 2 on sacrum; uniform, usually with light margins, not markedly constricted mid-dorsally, fading out above lateral line, in light phase disappearing completely resulting in a uniform buff dorsal colour; no dorsolateral line, lateral line from shoulder to hip conspicuous; transverse hour-glass markings on tail; belly yellowish grading into lightly mottled brown on sides below lateral line; underside of tail more or less uniform with brick-red speckling; limbs with more or less well-defined banding, invisible in light phase, underside of limbs plain.

Female; – mid-dorsal stripe prominent, often quite light; transverse bands generally dark, constricted or interrupted mid-dorsally, and sometimes divided by a whitish vertebral line.

Dimensions: – Adult male, snout to vent 60 mm, tail ca. 120 mm.

Type: – Adult male, B.M.N.H. 1954.1.2.60 Drax Hall, 3 km E. St. Anns Bay, St. Ann (18°25'N 77°11'W). Coll. E. Williams & G. Underwood, 29.vii.53. 7 paratypes, M.C.Z. 52364–5 (+4), same data.

Range: – (fig. 5) – Extends along the narrow northside dry coastal strip from Montego Bay to St. Mary. It has been recorded from several localities in St. Mary on the west side of the Wag Water basin. At Darling Spring it just enters the Rio Cobre basin. West of Montego Bay it probably grades into *neckeri*.

For complications involving the eastern end of its range see the section “areas of intermediate populations”, pp. 42–44.

Other material examined from: StJ., Montego Bay (1), Greenwood (2); T., Salt Marsh (3), Windsor (1); StA., Runaway Bay (1), Antrim (1), Dairy Cave (1), Ocho Rios (3); StM., Highgate (2), Cabaritta I. (5), Troja Gap (1), Clonmel (1), Aqualta Vale (5); StC Darling Spring (3).

Discussion: – This, the plainest member of the *lineatopus* group, is named after the faintest of the Pleiades. Of seven sisters Merope was the only one to marry a mortal, her star therefore shines less brightly than those of her sisters.

This form appears to be the north-side counterpart of *lineatopus*; it occupies similar low lying coastal country. In general habits it resembles *I. lineatopus* more than do the other members of the group. Males of *I. merope* are found frequently in exposed situations such as on tree trunks and in bushes. In consequence they are

almost as readily captured as *lineatopus*; it is therefore somewhat surprising that sufficient material has not already been collected for the distinctness of this form to have been recognised. Our type series differs from the specimens from other parts of the range in that the majority of tail whorls have only 3 scales dorsally. In St. Anns Bay and Cabaritta Island, the representatives of the *lineatopus* group are clearly referable to this form by virtue of their near lack of pattern and their limited power of colour change. They do however have a strong orange centre to the throat fan in contrast to the more western specimens.

On the west side of the Wag Water basin the lizards are clearly *merope* on the balance of characters but the fan is like that of *lineatopus* (in colouration, not squamation); it has a large light orange centre.

It should be added that this form appears to be less fully differentiated than *l. lineatopus*.

Further collecting shows that *merope* definitely extends into Hanover (Lucea). A specimen from Samuels Bay (16 km. W. of Lucea) shows some approach to *neckeri*. Fig. 5 has been amended accordingly.

ANOLIS LINEATOPUS NECKERI Grant

Anolis lineatopus neckeri [partim] Grant (1940). *Jamaica Today*: 155.

Anolis lineatopus neckeri [partim] Grant (1940). *Bull. Inst. Jamaica, Sci. Ser.*, 1: 92

(Type M.C.Z. 45087). Mandeville, Manchester. Coll. C. Grant, 11. iv. 37.

Description: – (fig. 6) – A slender anole with narrow head like Portland Ridge *lineatopus*. (Short diagnosis on p. 11) Differs from *lineatopus* in some points of squamation and colour pattern.

Head: – a) supraorbital semicircles separated by 2, rarely 3, scales, posterior frontal shorter to longer than first orbital c) no internarial eminence f) anterior subocular separated from canthal ridge by 2–3 scales, rarely 1 g) 6–8 labials i) interparietal small, about half size of supraocular disc, separated from supraorbital semicircles by 4–6 scales.

Fan: – scales on anterior margin swollen, keeled, imbricating; other fan scales small, swollen, some keeled, some granular.

Trunk: – belly scales keeled, moderately imbricating, keels tend to be arranged in lines.

Colour: – Male: head uniform brown; around eye russet; faint white spots from labials onto sides of neck; interparietal paler than surrounding scales; chin faint orange to yellow; fan in general appearance medium to dark orange centre, wide or narrow margin with grey to yellow colour, interstitial skin dark orange with pale margin, scales white. Trunk: in dark phase broad light mid-dorsal stripe flanked by dark brown transverse bands, variable in number, uniform or variegated; light line from shoulder to hip tinged with green; patternless phase pale verdigris to yellow-green. Limbs with faint banding. Female: broad light mid-dor-

sal stripe traversed by three dark brown, light edged, hour-glass markings; light line from shoulder to hip with greenish tinge; dark lines on throat.

Dimensions: – Adult male, snout to vent 60 mm, tail 115 mm; female, snout to vent 40 mm, tail 70 mm.

Range: – (fig. 5) – On present data the range can be defined only in very broad terms. It appears to occupy the western end of the island and the moist forest regions of the centre of the island through the Cockpit Country to the edge of the Wag Water Valley. It has not been recorded in the Blue Mountains. (For further discussion of the eastern end of the range see the section “areas of intermediate populations,” pp. 42–44). Across the Troja gap its range appears to be interrupted by *lineatopus* and *merope*.

Recorded from: – W., Torrington, Sav-la-mar, Bluefields, Negril; H., Booby I., Dolphin Pen, Lances Bay, Lucea; StE., Happy Grove; StJ., Cambridge; M., Mandeville, Penzance; StC., Back Pasture, Watermount, Mount Diablo, Linstead, Middle Bonnet, Sligoville; KStA., Constant Spring.

Discussion: – This form is, apart from *reconditus*, the least known of the Jamaican anoles. Its shyness and secretiveness in the middle and eastern parts of its range make it one of the more difficult anoles to collect and in this behaviour it is quite unlike the other subspecies of *lineatopus*. On Grant's evidence that it overlaps *lineatopus* without intergradation at Mandeville and at Constant Spring it should be regarded as a species. We would however, comment on this general problem of overlaps that what on a small scale map must be represented as a zone of overlap is perhaps in the field a general scattering of the open country form (*l. lineatopus*) with pockets of the shade-loving form (*neckeri*) here and there. Preserved specimens from these localities are definitely of two kinds: (1) individuals with strongly marked gridiron pattern and (2) patternless individuals. Only further collections can clarify the situation. It was in any case unfortunate that the describer chose an area of overlap as type locality for what he regarded as a subspecies.

It will be noted that we have subdivided *neckeri* as originally proposed by Grant into three subspecies; his scanty material was evidently not sufficient for the differences to be noted. It was named for Walter L. Necker.

There are evident differences between various local populations of this form. We lack a sufficient number of series to give any systematic account however. In the western parts of Hanover and Westmoreland the population is rather distinct and we had originally considered erecting a separate subspecies. The posterior frontal is as long as or a little longer than the first orbital, elsewhere it is smaller (Pl. IIb). The green phase is distinctly yellowish, elsewhere it is more bluish. The yellow on the chin is more pronounced than elsewhere. The throat fan has a less dark orange centre and a wider and yellower border. The Negril and Savanna-la-mar specimens show these characters most clearly. The Hanover specimens are nearer to *merope* in that the green phase and the orange chin is less pronounced. We know nothing about the relationship between *neckeri* and *merope* in eastern Hanover and western

St. James. In western St. Elizabeth in the valley running from Middle Quarters to Newmarket is a rather variable population. A short series showed marked individual differences in respect of dark pattern, degree of greenness and extent of orange on throat fan. It may be comparable to the St. Margarets Bay population (See p. 42).

ANOLIS LINEATOPUS AHENOBARBUS subsp. nov.

Anolis lineatopus neckeri [partim] Grant (1940). *Jamaica Today*: 155.

Description: – (fig. 6, Pl. IIIa. IVa) (applicable to topotypes) a little smaller than *lineatopus*. Differs from *lineatopus* in points of squamation and colour.

Head: – a) semicircles separated by 2 scales; posterior frontal shorter than first orbital c) no internarial eminence f) subocular separated from canthal by 2 scales, rarely 3 i) interparietal small, separated from supraocular semicircles by 5–6 scales. Fan: – scales on anterior margin swollen, mildly keeled, imbricating; other scales swollen, keel-less, coarsely granular.

Trunk: – scales on shoulder swollen, not imbricating, revealing the interstitial skin; belly scales about as broad as long, swollen, keeled, not imbricating.

Limbs and digits: – fine, weakly keeled scales on dorsal side of hind limbs; scales on anterior face a little larger, weakly keeled, not imbricating; scales on ventral face medium, keel-less, not imbricating, uniform from groin to knee; subdigital lamellae 27–32, mostly 28–30.

Colour: – Male; head uniform brown above; around eye greenish-blue; white spots on labials which usually extend onto sides of neck; chin bright orange-yellow; fan: interstitial skin a dark orange extending nearly to periphery; scales white with greenish tinge; fan fades in alcohol to a dark grey. Trunk: broad light mid-dorsal stripe flanked by 3 transverse uniform brown bands on trunk, generally 2 on sacrum but these sometimes irregular; light line from shoulder to hip, this and sides show distinct green tinge especially in light phase. Belly opalescent with a greenish tinge, groups of brick red scales beneath tail. Limbs: transverse brown banding on limbs, more conspicuous on hind limbs, obscure in some phases. Female; yellow on chin pronounced; broad light stripe down back; dark transverse bands reduced mid-dorsally; light line on side more or less distinct; belly opalescent yellow.

Dimensions: – Adult male, snout to vent 65 mm, tail ca. 120 mm. Type: – Adult male B.M.N.H. 1954.1.2.58 Soldiers Bay, 2 km E Port Antonio, Portland (18°12'N 76°26'W). Coll. G. Underwood, 10.v.52. 3 paratypes, M.C.Z. same collection data; 5 paratypes, M.C.Z. 52352–3 (+3) same locality coll. E. Williams & G. Underwood, 22.vii.53.

Range: – (fig. 5) – This form occupies eastern Portland and St. Thomas. It is known along the coast of Portland eastward from Port Antonio. It is found in the John Crow Mountains and extends onto the south face of the mountains from the

vicinity of Bath west to the upper reaches of the Plantain Garden River. It has not been found in the open country south of Bath. It is quite likely that it occurs in the Rio Grande valley but we have no records.

Other material examined from: – P., Downers Bluff (1), Port Antonio (4), Boston Bay (2), Priestmans River (2), 5 km WSW of Priestmans River (1), 2 km W Ecclesdown (9), 3 km W Ecclesdown (8), Fair Prospect (1), Christmas River (2); St.T., 2 km NE Amity Hall (1), Bath Fountain (9), Bath-Corn Puss Gap Trail (3), Cuña Cuña (3), 2½ km N Whitehall (6).

Discussion: – Because of the colour of the chin we name this form *ahenobarbus* (*ahene* = bronze, *barbus* = beard) after the Roman family of this name, of which Nero was a member.

The John Crow Mountains in eastern Jamaica, remarkable for their heavy rainfall (the highest in the island; probably exceeding 750 cm per annum over a large part), are one of the few areas which retain a considerable extent of virgin forest, a consequence of the inaccessibility and roughness of the terrain. C.B. Lewis and G.R. Proctor of the Institute of Jamaica made an exploratory collecting trip and brought back the first material in 1951. A later collecting trip by one of us (Underwood) secured further specimens and confirmed the distinctness of the new form. Subsequently specimens now assigned to the same form were found to be readily obtainable at a number of points beside the main road along the coast.

Of the members of the *lineatopus* group this is the most variable in general appearance. Such are the differences of specimens from various parts of the range that we at one time contemplated erecting three subspecies.

The specimens from Priestmans River, on the coast east of Port Antonio, resemble the topotypes. Further collecting southwards revealed an apparent size cline, no large specimens being seen at all at Christmas River. This cline appeared to be confirmed by a collection of small specimens made by W.G. Lynn on the Bath-Corn Puss Gap trail and in the upper Plantain Garden River valley. However, as most of these specimens were taken under stones whilst collecting other zoological material, this could have biased the collecting. The collection of a full-sized adult male from 2 km NE. Amity Hall seems to confirm this view.

Specimens are common near the fountain at Bath and differ somewhat from the topotypes. Mottling is rather pronounced on the neck and the back of the head. Colour around the eye tends to russet. The labial spots are yellow; chin bright orange-yellow. The fan has a dark orange centre of variable extent; the sides have 5 mottled transverse bands, the dorsum in light phase is dull green.

In the John Crow Mountains west of Ecclesdown the population is somewhat different; the mottling on the head marked; around eye rich yellow above, blue-green below; orange on chin pronounced; fan with dark orange centre and grey margin; larger number (8–9) of irregular transverse bands; green on sides bright in light phase. One of the John Crow collections (3 km W Ecclesdown) further differed in that 7 of the 8 specimens had broad heads with a distinct internarial

eminence somewhat more pronounced than in the broad headed *I. lineatopus* (Pl. IVa, b).

AREAS OF INTERMEDIATE POPULATIONS

On the north coast a series of specimens of the *lineatopus* group from St. Margarets Bay appear to indicate that a complex situation exists. The colours of the fans include: orange centre with yellow margin (*lineatopus*), dark orange centre with yellow margin (new combination), dark orange to margin (*ahenobarbus*) and restricted orange centre with grey margin (*merope*). Dorsal patterns ranged from nearly uniform vermiculate brown to more or less distinct dark banding, and some specimens showed a greenish cast. In squamation most fans tended towards *lineatopus* type but all had some admixture of scales of *I. ahenobarbus* type. This seems to be a hybrid population involving *ahenobarbus*, *lineatopus* and perhaps *merope*.

A short series from Hope Bay (ca. 4½ km W St. Margarets Bay) is clearly assignable to *lineatopus* on the balance of characters but shows some slight evidence of intergradation. A short series from Port Antonio, East Harbour (ca. 8 km E St. Margarets Bay) is assignable to *ahenobarbus* but shows traces of intergradation.

A single specimen from Folly Point (ca. 8½ km E St. Margarets Bay) just east of the previous locality seems, on the totality of characters, to be unequivocal *I. lineatopus*. Specimens from the open country at the mouth of the Rio Grande (1 km E St. Margarets Bay) have the body pattern of *I. lineatopus* but the orange on the fan is more extensive than in typical specimens. In this eastern north shore area the open country specimens more closely resemble *lineatopus* while those from more shaded areas closely approach *ahenobarbus*. Thus St. Margarets Bay is well shaded; Hope Bay, Rio Grande and Folly Point are very open situations. It is fairly certain that these specimens would be interpreted as local variants of *lineatopus* were the St. Margarets Bay situation not known.

This situation is peculiar and complex, but it is still moderately simple in that only 2 forms are involved: *lineatopus* and *ahenobarbus*. Somewhat farther to the west, from the western side of the Wag Water valley eastwards to the neighbourhood of Buff Bay and Caenwood, is an approximately triangular area occupied by a number of different populations more difficult to analyse. Some specimens of these populations were caught long before the complications of the general situation were fully appreciated; some of our views regarding these specimens are therefore subject to revision. It is after protracted discussion of how to treat the situation in the western Portland north-shore area that we feel in hearty agreement with the saying that a paper is never finished, merely abandoned.

The lizards in this area appear to show characters of four subspecies: *lineatopus*, *merope*, *neckeri*, and *ahenobarbus*. In respect of the belly scales, they all differ from *lineatopus* in that the scales are small, somewhat swollen and with very small,

only slightly overlapping free margins. Further, none of them have fan scales as thin and flat as *lineatopus*, nor yet as granular as *ahenobarbus*. In none was the power of colour change seen to be as extensive as in *ahenobarbus* and *neckeri*. In all except the Caenwood specimen the fan was more strongly coloured than in *merope*: it was either dark orange with a grey border as in *neckeri* or medium orange with a yellow border as in *lineatopus*.

Whilst variation between different localities is marked, the lizards at any one locality appeared to be no more variable than in localities well away from overlap zones.

These populations are described and listed below.

2 km N Mount Industry (4): Strong pattern of transverse banding like *lineatopus*, no light dorsolateral line; fan as in *neckeri*; fan scales with variable amount of granules; sharply keeled belly scales.

4 km S Castleton Gardens (1): Reticulate brown on flanks, transverse bands on back weak and incomplete; fan like *lineatopus*; some granules in centre of fan; belly scales keeled.

Agualta Vale (5): Almost patternless, a little speckling on flanks; fan like *lineatopus*: fan with only a few granules; belly scales variable from sharply keeled to keel-less (assigned above to *merope* on balance of characters).

4 km NW Buff Bay (1): Simple transverse bands; fan like *neckeri*; fan scales only slightly granular; belly scales strongly keeled.

Enfield (3): Light simple transverse bands; fan like *neckeri*; fan scales granular; belly scales with strong to medium keeling.

Buff Bay (3): Simple transverse bands; fan like *neckeri*; fan scales somewhat granular; belly scales sharply keeled.

Caenwood (1): Almost patternless; fan pale but very widely coloured; fan scales granular; belly scales with medium keeling. (would be assignable to *merope* on balance of characters).

Two female specimens were collected from 8 km SW. Buff Bay. Being female, they did not show diagnostic characters well but in the full colour change from dark to a dull uniform green they resemble *neckeri*. They were taken in moist limestone forest. These two specimens suggest the possibility that typical *neckeri* extends along the north face of the Blue Mountains in Portland but formal identification of the lizards in this area as *neckeri* should wait on the collection of male specimens.

The other specimens all come from more open country along the coast and in river basins. In their habits they were all about intermediate between *lineatopus* and typical *neckeri* and thus similar to *merope*; they were not found in such exposed situations as *lineatopus* nor were they as secretive and difficult to locate as *neckeri*.

The attempt at interpretation of this situation raises many problems. If it were an area of secondary intergradation we might expect the populations to be highly variable as at St. Margarets Bay. On the other hand the average radius of migration

in the lifetime of a single lizard is probably small. The distribution is patchy, corresponding with areas of suitable vegetation. These two factors would tend to encourage inbreeding within local populations. The highly variable populations at St. Margarets Bay might thus be interpreted as the result of fairly recent hybridization. The more uniform north-shore populations to the west could then be regarded as having arrived at this uniform condition after a period of inbreeding (and perhaps of local selection or genetic drift). The differences between the several uniform populations would then be attributed in part to the different initial ingredients, in part to the chance fixation of different genes. Human alteration of the vegetation may have exerted an influence.

To the population of this area (once perhaps a sort of no-mans-land) each of the surrounding subspecies seems to have made a contribution. Typical *lineatopus* perhaps arrived on the north coast after the initial period of confusion, for it is clearly distinct (if not entirely uncompromised) in the easterly portion of this area except at St. Margarets Bay.

It is to be regretted that a lizard which lays eggs singly and probably takes about two years to mature is unpromising material for genetical study, yet such a study, as well as much additional field work is evidently necessary for a final solution of the problems to which here we can only call attention. From a strictly practical standpoint it is very difficult at present to know how to treat nomenclaturally such a complex as this northeast shore of Jamaica.

ANOLIS RECONDITUS sp. nov.

Description: – (fig. 6 & Pl. IIa; short diagnosis given on p. 12). In general habitus this lizard resembles Kingston *l. lineatopus* but is somewhat larger.

Head: – a) supraorbital ridges prominent; semicircles separated by 1 scale; posterior frontal shorter than first orbital b) frontal area shows pronounced depression with ca. 14 smooth sharply keeled scales; supraorbital ridges conspicuously bowed outwards around frontal depression; a fairly well defined median row of scales runs forwards from between the supraorbital semicircles to the internarial eminence – f) anterior subocular separated from canthal ridge by 1/2 scales g) labials 6 (all counts) h) loreal rows 5/5 i) interparietal small, less than half size of supraocular disc; separated from semicircles by 4/5 scales.

Fan: – scales on anterior margin swollen, slightly keeled, imbricating; other fan scales narrow, swollen, slightly keeled.

Trunk: – scales on belly rounded, keel-less, not imbricating.

Limbs and digits: – small, keeled, sub-imbricating scales on dorsal surface of hind limb; larger, flat, keeled, sub-imbricating scales on anterior face; small swollen, slightly keeled scales on ventral face not imbricating; subdigital lamellae 34/34.

Tail: – whorls with 4 dorsal and a single row of 3 scales ventrally.

Colour: – Male: head uniform sombre brown above; lips and chin greyish white;

temporal region dark slate, white spot in front of tympanum; blue-grey on sides of neck; interparietal not conspicuously paler than surrounding scales. Fan: interstitial skin orange-brown to margin, scales whitish. Trunk: broad light mid-dorsal stripe, 4 transverse, green-brown hour-glass markings, the latter 2 incomplete; light stripe on shoulder fades out on flank; tinged overall with sombre green. Little power of colour change.

Dimensions: – Adult male, snout to vent 78 mm, tail 162 mm.

Type and only known specimen: – M.C.Z.53274, adult male ca. 4 km NNW Trinityville, St. Thomas, elevation ca. 760 m (17°59'N 76°31'W). Coll. W. G. Lynn & G. Underwood 19.ii.53. (fig. 5).

Discussion: – The specific name alludes to the fact that this form has escaped observation for a century and so far has eluded attempts to secure further specimens. The type specimen was taken on the trail from Trinityville up to Half-a-bottle Peak at an altitude of about 2500 feet. At this altitude all the natural vegetation has been destroyed. At the type locality where the trail crosses a tiny stream and levels off for a few yards, there is some bush and, on the level ground, some rocks and logs. These latter were being turned for frogs when a large anole unexpectedly ran out from under a log. On a cautious approach being made fifteen minutes later, an anole was seen to run under the log and was so situated that it was possible to noose it. Careful search on the return journey and a second visit failed to yield any further specimens. The only anoles visible on the vegetation in the immediate vicinity were *opalinus*, and further afield in scrub vegetation and sometimes on the ground, *garmani*. Careful examination of the vicinity gave not the slightest hint of the occurrence of any other anoles.

Examination of the specimen makes it clear that it belongs to the *lineatopus* group; as a further check the pericardium was examined and found to be quite without pigment. That it merits full specific rank is a subjective judgement founded on the distinctiveness of its characters. One can only speculate as to the relations of this form with the other members of the group. The locality, on a ridge overlooking the Morgans River (a tributary of the Morant River), lies between *lineatopus* to the west and *ahenobarbus* to the east. In view of its size (it is the largest member of the group) and apparently secretive habits, it might well overlap either of the adjacent forms.

GENERAL DISCUSSION

THE island of Jamaica has, as compared with a continental area, a rather scanty fauna. Against the poverty in respect of higher taxonomic units may be set a remarkable complexity at lower levels, well shown by the anoles which present a number of features of considerable zoological interest.

The anoles are highly specialised arboreal lizards approaching the chameleons in the extent of the adaptive modifications which they show. Nevertheless we may have five endemic Jamaican anoles in one area, three of them in abundance. In addition to these there may be found abundantly in the western parts of the island the, apparently more recently arrived, probably Cuban, *Anolis sagrei*.

Two of the old established forms, *Xiphocercus valencienni* and *Anolis garmani*, do not appear to show any tendency to formation of subspecies. *Xiphocercus*, in particular, is found over a wide range of ecological conditions.

Opalinus, the species sibling to *grahami*, has numerous variants, some of them sufficiently localized to give a measure of distinctness to local populations, but the modest measure of geographical differentiation of this form may be due in part to relatively recent species origin.

The occurrence of a sharply differentiated subspecies of *grahami* at the eastern end of the island may have some ecological significance since the eastern part is an area of high rainfall. The detailed distribution of the two forms in the boundary zones is less readily explicable on an ecological basis, but it should perhaps not be forgotten that human activity has greatly altered the original vegetation.

The *lineatopus* group presents a situation of especial interest. The distribution of the four subspecies lends itself to an ecological interpretation. On the dry coastal areas of north and south we have *merope* and *lineatopus* respectively. Both are forms with limited power of colour change, and both are brown in all phases. In the damper and more forested parts of the island we have *neckeri* in the middle and west and *ahenobarbus* to the east. It is an interesting fact that nearly all the recorded localities for *Peripatus* lie within the range of these two forms. They have in common a considerable power of colour change, and each shows a brown and a green phase.

Asprey & Robbins (1952) in surveying the vegetation of Jamaica, distinguish a dry limestone scrub forest occupying an extensive area on the south coast and a

narrow strip on the north coast. As far as our data go *l. lineatopus* extends over the whole of the dry limestone scrub forest between the Black River and Port Morant River. This forest type is well represented along a coastal strip east of Montego Bay, and there are fragments west of Port Maria and Buff Bay, which all lie within the range of *l. merope*. The lower parts of the Blue and John Crow Mountains are clothed by mist forest and lower montane rain forest. The principal part of the known range of *l. ahenobarbus* lies in the eastern part of this forest. (However, in the Yallahs valley *l. lineatopus* does approach the mist forest). The distribution of *l. neckeri* appears to be centred on the wet limestone forest of the central and western parts of the island.

In the Yallahs valley *l. lineatopus* occupies territory where one might by studying the map expect to find a green member of the group. As has been suggested above however, it appears to have invaded this area in the rainshadow of the Blue Mountain peaks.

The complicated contacts of *l. lineatopus* with other subspecies on the north shore will clearly be worth further study. Even the present picture prompts us to some general comment. It is a common postulate that when two closely related forms, nearly equivalent ecologically, encounter one another, they may either intergrade and lose their distinctness, or one may invade the territory of the other and supplant it, or they may further differentiate and come to live side by side. The complex situation described along the *l. lineatopus* boundary on the north shore and elsewhere seems clearly to show that the reaction between two such forms is not broadly predictable. No doubt local differences of genotype, topography and ecology combine to produce the complexity of such an actual situation. The situation is evidently dynamic and will probably repay periodical study.

The distribution of morphological characters is interesting as distinct from colour pattern. The ability to change colour is so great in these animals that colour pattern is of extremely uncertain value in preserved material and may, due to conditions of preservation, be completely misleading. Morphological characters are frequently regarded as the only "safe" characters available to the museum worker, and in the present case would appear at first sight to be preferable. Three of our groups are clearly distinguished on morphological characters. The *grahami* and *lineatopus* groups are, however, difficult to separate on purely morphological grounds. The three members of the *grahami* group show marked morphological differentiation of the two forms which intergrade but only slight differentiation of the full species which is sympatric with the other two. Amongst the four subspecies of *lineatopus* there are four pairs of morphological characters sufficiently clearly contrasted to be valuable taxonomically. Only one pair of these can be used to help characterize good subspecies – the fan scales in *ahenobarbus*. Of the three other pairs of characters, that of the squamation of the underside of the thigh distinguishes only the Hellshire Hills-Port Henderson Hill population of *lineatopus*. Differences in the shape of the head, broad with an internarial eminence as opposed to

narrow with a tapering snout, occur within *lineatopus* and *ahenobarbus*. Narrow-headed *lineatopus* are found at Portland Ridge and less commonly elsewhere. Eight of nine specimens of *ahenobarbus* from one locality in the John Crow Mountains have broad heads with a pronounced internarial eminence (Pl. IVb). From nearby and more distant localities all specimens have narrow heads. Yet the contrast between the two conditions is so striking that it might seem entirely reasonable to use it as a basis for discrimination of two full species. If such a situation of high morphological variability be usual amongst anoles, then a general revision of the more than three hundred forms would be an immense undertaking, and if the situation in Jamaica be representative, it would be necessary to see them all in life. A less ambitious study could hardly be regarded as satisfactory.

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THE ANOLINE LIZARDS OF JAMAICA

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CORRECTIONS

- P. 16, line 2. Should read, " pp. 7 & 8 " .. (not pp. 738).
P. 28, line 3. Should read, " Anolis grahami aquarum "
.. (not Anolisgrahamiaquarum).
P. 31, line 18. Should read, " Pl. IIIb " .. (not Pl. IIb).

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