A Review of *Anolis angusticeps* in the West Indies

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In 1856 Hallowell described *Anolis angusticeps* from Cienfuegos, Las Villas Province, Cuba. In 1894 a closely related species, *Anolis oligaspis* Cope, was named from New Providence Island, Bahamas. These two species were ultimately combined (Barbour, 1937, p. 128) as two subspecies of *A. angusticeps*, the nominate form occurring on Cuba and the Isla de Pinos, and *A. a. oligaspis* in the Bahamas (New Providence, Andros, Long islands). The Bahaman subspecies has generally been regarded as rare and has been much less well represented in collections than *A. a. angusticeps*. Two additional subspecies have more recently been named, *A. a. chickcharneyi* Oliver (1948) from South Bimini island in the northwestern Bahamas, and *A. a. paternus* Hardy (1967) from the Isla de Pinos. Hardy (1967) summarized the pertinent data on all specimens of *A. angusticeps* available to him but made little comment on the validity of *A. a. chickcharneyi*. Since we have had considerably more experience in the Bahamas with *A. angusticeps* than previous workers, since the senior author collected the species in Cuba and the Isla de Pinos (under National Science Foundation grants G-3865 and G-6252), and especially since we have made several pertinent observations on the habits of this supposedly rare species, we have attempted to review the accumulated data on the variation and habits of *Anolis angusticeps*.

We have studied 276 specimens of *A. angusticeps*. Many of the Bahaman specimens are in the Albert Schwartz Field Series (ASFS); the balance of the lizards have been borrowed from the following institutions: Academy of Natural Sciences of Philadelphia (ANSP), American Museum of Natural History (AMNH), Carnegie Museum (CM), Museo y Biblioteca de Zoología de la Habana (MBZH), Museum of Comparative Zoology (MCZ), Museum of Zoology, University of Michigan (UMMZ), University of Florida collections (UF/FSM), United States National Museum (USNM), and the Instituto de Biología, Academia de Ciencias de Cuba (IB). We wish to thank the following persons in charge of these collections: James Boehlke, Edmond V. Malnate, Charles M. Bogert, George W. Foley, Neil D. Richmond, Miguel Jaume, Clarence J. McCoy, Jr., Ernest E. Williams, Walter Auffenberg,

Lewis D. Ober, Charles F. Walker, Doris M. Cochran, James A. Peters, and Orlando H. Garrido. In the field we have had the assistance of Edwin B. Erickson, John R. Feick, William H. Gehrmann, Jr., Ronald F. Klinikowski, David C. Leber, James D. Smallwood, Barton L. Smith, Willard M. Stitzell, and George R. Zug, whose help in collecting these anoles in Cuba, the Isla de Pinos, and the Bahamas is gratefully acknowledged. We are especially fortunate in having Mr. Malnate check various data for us on the holotypes of *A. angusticeps* and *A. oligaspis*, both of which are in the Academy of Natural Sciences of Philadelphia. We have examined the holotypes of *A. a. chickcharneyi* and *A. a. paternus* ourselves. The large series of *A. angusticeps* taken by Thomas W. Schoener on South Bimini and now in the Museum of Comparative Zoology has added materially to the quantity of Bahaman specimens.

Hardy (1967) used five characters in his discussions of variation in *A. angusticeps*. These are 1) presence or absence of ventral keeling; 2) number of scales in the first and tenth caudal verticils; 3) number of scales between the seventh canthals (seventh canthals as counted by Oliver, 1948, but first canthal as counted by us, beginning at the anterior margin of the orbit); 4) number of postmental scales; and 5) color. We found other counts useful for differentiation of subspecies in other anoles, and accordingly we have taken data on the number of loreals on one side, the minimal number of scales separating the supraorbital semicircles, the number of scales between the supraorbital semicircles and the interparietal on each side (written as a fraction, i.e., 1/1), number of fourth toe lamellae on phalanges II and III, presence or absence of sculpture on head scales, and presence or absence of keeling on the scales on the anterior face of the thigh.

SYSTEMATIC ACCOUNT

Anolis angusticeps angusticeps Hallowell, 1856

Anolis augusticeps (sic) Hallowell, 1856, Proc. Acad. Nat. Sci. Philadelphia, p. 228 (Cienfuegos, Las Villas Province, Cuba; holotype ANSP 7789).

Definition. A subspecies of *A. angusticeps* characterized by smooth ventral scales, modally 7 scales between first canthals, modally one row of scales between supraorbital semicircles, median dorsal scales in first caudal verticil moderate in number, postmental scales modally 4, femoral scales variably keeled or smooth, head scales usually smooth in males, sinuously rugose in females, and ventral color white to whitish, not yellow.

Distribution. Cuba; intergrades between *A. a. angusticeps* and *A. a. paternus* known from five localities in Pinar del Río Province in western Cuba (Fig. 1).

Size. Largest male (UMMZ 70046, vicinity of Soledad, Las Villas Province) 52 mm snout-vent length; largest female (MCZ 11146, Soledad, Las Villas Province) 43 mm.

Variation. The sample of 107 *A. a. angusticeps* may be divided into three separate groups for further discussion: 1) Pinar del Río Province (west), 2) Habana-Matanzas-Las Villas provinces (central), 3) Camagüey-Oriente provinces (east). When the entire lot of Cuban material is so divided, certain trends in scalation, especially in the arrangement of the head scales, are shown.

The number of scales between the first canthals varies from 3 to 10. The three samples have the following ranges, means and modes: 1) 3-9; mean 6.4, mode 6; 2) 5-10; mean 6.8, mode 7; 3) 5-9; mean 7.2, mode 7. There is an increase in mean number of snout scales between the first canthals from west to east, with the highest value in the Camagüey-Oriente sample. The low mean in Pinar del Río reflects the relationships of the western sample with *A. a. paternus* of the Isla de Pinos.

The number of loreals varies between 14 and 41, with no obvious tendencies toward higher or lower numbers in any region. Means are 25.2 (Pinar del Río), 25.3 (Habana-Matanzas-Las Villas), and 25.0 (Camagüey-Oriente).

All three samples of *A. a. angusticeps* have the supraorbital semicircles modally separated by one row of scales; this condition occurs in 17 of 33 Pinar del Río lizards, 30 of 45 lizards from Habana-Matanzas-Las Villas, and 23 of 27 lizards from Camagüey-Oriente. On the other hand, the semicircles are in contact in some specimens, the number in the three samples being 14 in the west, 13 in the central sample and 4 in the eastern sample. Two lizards in both the Pinar del Río and the Habana-Matanzas-Las Villas samples have the semicircles separated by two scales; no Camagüey-Oriente lizard has this condition. The highest incidence of the non-modal condition of semicircles in contact occurs

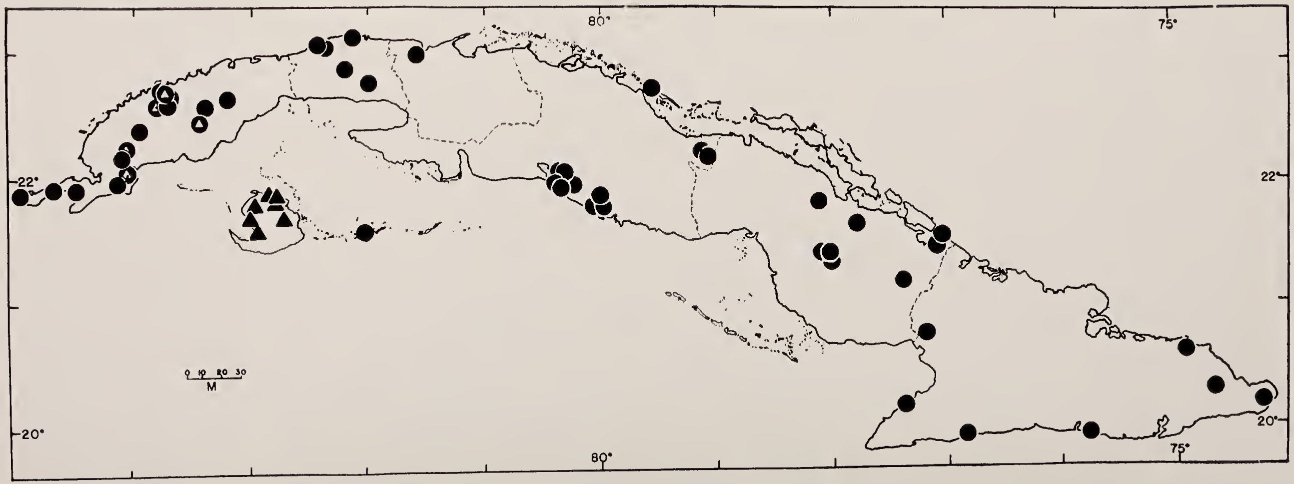

Fig. 1. Map of Cuba and the Isla de Pinos. Solid circles indicate stations whence specimens of *A. a. angusticeps* have been examined, solid triangles *A. a. paternus*. Solid circles with included white triangles in Pinar del Río Province indicate localities where specimens intermediate in ventral keeling between *A. a. angusticeps* and *A. a. paternus* occur.

in the western Pinar del Río sample; as in the case of the number of scales across the snout between the first canthals, the high incidence of semicircles in contact in Pinar del Río reflects the relationship of *A. a. paternus* to the Pinar del Río sample. *A. a. paternus* modally has the semicircles in contact.

The number of scales between the interparietal and the supraorbital semicircles varies between 0/0 and 2/2, with asymmetrical conditions (0/1, 1/2) also occurring. The mode is strongly 1/1 in all samples. The number of supraorbital scales in contact with the interparietal is modally 0/0 in all samples, with counts of 0/1, 1/1, 1/2, and 2/2 also encountered. None of these latter categories closely approaches the frequency of 0/0 in any sample.

Number of fourth toe lamellae on phalanges II and III varies between 14 and 22, with means of 17.6 in the west and east, and 17.4 in the central sample. No geographical trend is present.

Scales in the median dorsal row in the first caudal verticil range from 4 to 7, with means of 5.3 in the west and central lizards, and 5.4 in the Camagüey-Oriente sample. Tenth verticil scales vary between 3 and 6, with means of 4.4 in the western and eastern samples and 4.1 in the central sample.

Number of postmental scales varies geographically. The total variation in this character is 3 to 8; the means, from west to east are 5.7, 5.1 and 4.7, showing a distinct reduction of number of postmentals from west to east. The modal number is 6 in the Pinar del Río lizards and 4 in the Camagüey-Oriente region; the central sample is bimodal, with equal numbers of lizards having 4 and 6 postmentals, and an almost equal number of lizards having 5 postmentals.

From the above data the west-east cline in some scale characters (snout scales between first canthals, contact of supraorbital semicircles, number of postmental scales) is clearly demonstrated. The influence of *A. a. paternus* on the Pinar del Río lizards (or, preferably, the intermediate nature of the Pinar del Río lizards between the subspecies *angusticeps* and *paternus*) is reflected in the counts and arrangement of the head scales in the western sample. The ventral scales in some Pinar del Río lizards will be noted below.

The dewlap color in *A. a. angusticeps* is variable but apparently not correlated with geography. The basic color is pale orange or yellowish orange (peach, apricot; Maerz and Paul, 1950, Pl. 10 D 7, is a good reference, recorded for a specimen from Las Villas). A male from Pinar del Río had the dewlap yellow, one from the Sierra de Trinidad in Las Villas Province had the dewlap orange, and another male from Trinidad was recorded as having the dewlap pale orange (Pl. 2 A 10). Ruibal (1964, p. 488) reported that the dewlap color of Cuban examples was peach (yellow-pink), and Collette (1961, p. 139) likewise considered the dewlap peach-colored.

Special mention is necessary of two specimens (IB 864-65) from Cayo Cantiles in the Archipiélago de los Canarreos, the string of islands and cays which extends eastward from Punta del Este on the eastern coast of the Isla de Pinos. These two male lizards, which might most properly be expected to represent the Isla de Pinos subspecies *paternus*, are assignable to the Cuban *A. a. angusticeps*. Both have the hindlimb and ventral scales smooth. Such a peculiarity of distribution suggests that *A. angusticeps* may have reached the Archipiélago de los Canarreos from mainland Cuba rather than serially from the Isla de Pinos to the west. Additional specimens from this island chain are greatly to be desired; it is even possible that Archipiélago *A. angusticeps* will ultimately be shown to be a distinctive subspecies restricted to that region. Several other reptiles (*Leiocephalus cubensis, Dromicus andreae*) have distinctive subspecies in the Canarreos, and *A. angusticeps* may follow suit.

Specimens examined. Cuba, Pinar del Río Prov., Cabo de San Antonio, 1 (USNM 51847); north shore, Ensenada de Corrientes, 45 km W Cayuco, 1 (AMNH 81343); Ensenada de Corrientes, 1 (MCZ 55551); Las Martinas, 1 (MCZ 50154); San Waldo, 4 km N Cortés, 1 (IB 1302); Sierra de Guane, 2 (MCZ 11149-50); 3.5 km NE Guane, 1 (AMNH 81344); Luis Lazo, 1 (MCZ 12220); near Viñales, 2 (MCZ 55568-69); pinelands near Viñales, 1 (IB 1060); San Vicente, 6 (AMNH 76510-11, AMNH 78233, AMNH 81342-43, AMNH 81345); 5.6 mi. NW San Vicente, 1 (AMNH 78231); Cueva del Cable, San Vicente, 2 (AMNH 78232, AMNH 78437); San Diego de los Baños, 2 (AMNH 58913-14); 1 km N Herradura, 8 (MCZ 59235-42); Rangel, 1 (AMNH 83089); Río Santa Cruz (not mapped), 1 (USNM 54416); *Habana Prov.*, Marianao, 22 (USNM 160915-23, USNM 160925-37); Bosque de la Habana, 1 (USNM 160924); Cueva de Cotilla, 9 km SW San José de las Lajas, 1 (AMNH 76512); Güines, 1 (AMNH 46520); Cueva de Rincón de Guanabo, 2 mi. E Playa de Guanabo, 1 (AMNH 96498); Sitio Perdido (not mapped), 1 (USNM 75816); Cayo Cantiles, Archipiélago de los Canarreos, 2 (IB 864-65); *Matanzas Prov.*, Matanzas, 1 (UMMZ 73924); *Las Villas Prov.*, 5 km SE Paso Caballo, 1 (AMNH 78234); Limones, Cienfuegos, 2 (MCZ 42317-18); Soledad, 2 (MCZ 11146, MCZ 92102); vicinity of Soledad, 1 (UMMZ 70064); Buenos Aires, Sierra de Trinidad, 1 (MCZ 42578); Guajimico, 16 mi. SE Soledad, 1 (AMNH 78238); Trinidad, 3 (AMNH 78235-36, AMNH 81347); 6 km W Trinidad, 1 (MCZ 59254); 1.8 mi. S Topes de Collantes, 1 (AMNH 96499); Cayo de Lanzanillo, 1 (IB 882); cliffs at San José del Lago, 1 (AMNH 78237); Sierra de Jatibonico, 1 (MCZ 7956); *Camagüey Prov.*, Los Paredones, Sierra de Cubitas, 1 (MCZ 73953); Río Jigüey, between Esmeralda and Jaronú, 1 (MCZ 59256); 20 km W Camagüey, 2 (AMNH 81322, AMNH 83608); Finca San Pablo, ca. 15 km SW Camagüey, 2 (MCZ 59257-58); Finca Santa Teresa, 9 km W Camagüey, 4 (MCZ 59244, MCZ 59246-47, MCZ 59262); Granja San Lucas, 9 km W Camagüey, 1 (IB 1208); Playa Santa Lucía, 1 (AMNH 83609); 15 km S Playa Santa Lucía, 3 (MCZ 59259-61); Martí, 1 (UMMZ 70992); *Oriente Prov.*, Birama, 32 km SW Victoria de las Tunas, 2 (MCZ 59251-52); near San Ramón, west of Campechuela, 3 (MCZ 59248-50); coast south of Pico Turquino, 1 (MCZ 42469); Playa Juraguá, 3.7 mi. E Siboney, 1 (AMNH 96500); upper Río Ovando, 1 (MCZ 52526); La Florida, Baracoa, 1 (IB 883); ca. 9 km SE Moa, ± 1000 feet, 1 (MCZ 59253); Cuchillas de Guajimero (not mapped), 1 (MCZ 42558); specimens with no locality data other than Cuba, 6 (ANSP 7997, AMNH 46512, AMNH 46563-65, USNM 83933); data for holotype of *A. a. angusticeps* (ANSP 7789) incorporated into analysis.

Anolis angusticeps paternus Hardy, 1967

Anolis angusticeps paternus Hardy, 1967, Carib. Jour. Sci., 6 (1-2), p. 25 (vicinity of Nueva Gerona, Habana Province, Isla de Pinos; holotype USNM 142156).

Definition. A subspecies of *A. angusticeps* characterized by keeled ventral scales, modally 6 scales between first canthals, modally supraorbital semicircles in contact, median dorsal scales in first caudal verticil low in number, postmentals modally 6, femoral scales keeled, head scales smooth to weakly sinuously rugose in males, sinuously rugose in females, and ventral color yellow.

Distribution. Isla de Pinos, where known only from the northern two-thirds of the island, north of the Ciénaga de Lanier; specimens intermediate between *A. a. paternus* and *A. a. angusticeps* in Pinar del Río Province, Cuba (Fig. 1).

Size. Largest male (AMNH 81326) 49 mm snout-vent length; largest females (AMNH 81334, USNM 142171, MCZ 11143) 38 mm.

Variation. The sample of 49 *A. a. paternus* is constant in several distinctive features of the subspecies, namely the keeled ventral scales and keeled scales on the anterior face of the thigh. The thigh keeling may be weak in some specimens, but it is always present. The number of scales between the first canthals varies between 3 and 8 (mean 6.1, mode 6), and the loreals range from 15-37 (mean 27.9). The supraorbital semicircles are more often in contact than not (55.1 per cent). There are most often 1/1 scales between the interparietal and the semicircles (22 individuals) but an almost equal number (17 lizards) have 0/0 scales (= interparietal in contact with semicircles on both sides) in this position. Counts of 0/1, 1/1, 1/2, 2/2, 2/0, and 3/1 also are found, with 1/2 having the highest frequency of these. Fourth toe subdigital scales vary from 15 to 22 (mean 18.8). Median dorsal scales in the first caudal verticil range from 4 to 7 (mean 4.6) and in the tenth caudal verticil are either 4 or 5 (mean 4.1). Postmentals vary between 5 and 8 (mean 6.2, mode 6).

Hardy has described the distinguishing features of *A. a. paternus* and our examination of the material agrees completely with his diagnosis. Field notes on series collected by the senior author likewise confirm the presence of the yellow ventral color, which may be very bright in intensity. The dewlap is variable, from pale pink (Pl. 1 B 10) to pale orange.

Discussion. A. a. paternus is obviously a derivative of the western populations of *A. a. angusticeps*, as Hardy pointed out. Ventral keeling occurs in some *A. a. angusticeps* from Pinar del Río Province (specimens from San Waldo, Viñales, San Vicente, Herradura, and the vicinity of Guane), with the highest incidence of keeling at the latter two localities. The relationships of the Isla de Pinos herpetofauna to that of Pinar del Río have been pointed out on several previous occasions, and the situation with *A. a. paternus* reinforces the closeness of the fauna of these two geographical regions. In the discussion of variation in *A. a. angusticeps* we have pointed out that several features of scutellation are clinal in nature, with the Pinar del Río populations showing affinities with *A. a. paternus*. Aside from the differences in ventral keeling and ventral color, the differences between the Cuban and Isla de Pinos subspecies are modal as are the scale distinctions in many subspecies of anoles.

The large number of specimens of *A. a. paternus* in contrast to the relatively smaller number from all of Cuba intimates that the lizard is more common in the Isla de Pinos. This was indeed the experience of the senior author, who encountered far more *A. a. paternus* on the Isla than on Cuba itself.

Specimens examined. Isla de Pinos: Nueva Gerona, 24 (USNM 27921-23, USNM 142156-73, UMMZ 60238, MCZ 11147-48); pinelands at Santa Bárbara, 2 (MBZH 33); just W Nueva Gerona, east base Sierra de Casas, 17 (AMNH 81323-26, AMNH 81328-40); 8.8 mi. SSW Nueva Gerona, 1 (AMNH 81327); Santa Fé, 1 (USNM 160914); Los Indios, 1 (MCZ 11143).

Anolis angusticeps oligaspis Cope, 1894

Anolis oligaspis Cope, 1894, Proc. Acad. Nat. Sci. Philadelphia, p. 430 (New Providence Island, Bahama Islands; holotype ANSP 26119).

Anolis angusticeps chickcharneyi Oliver, 1948, Amer. Mus. Novitates, 1383:2 (western end of South Bimini Island, Bahama Islands; holotype AMNH 68620).

Definition. A subspecies of *A. angusticeps* characterized by usually smooth ventral scales, modally 9 scales between first canthals, modally one row of scales between supraorbital semicircles, median dorsal scales in first caudal verticil high in number, postmental scales modally 6, femoral scales usually smooth but sometimes keeled, head scales usually smooth in both sexes, and ventral color white, not yellow.

Distribution. Islands of the Great Bahama Bank; specimens examined from North and South Bimini, Andros (including Mangrove Cay), Berry Islands (Frazer's Hog Cay), New Providence, Eleuthera, Great Exuma, Long Island and Cat Island; the species has not previously been reported from the Berry Islands nor Great Exuma (Fig. 2).

Size. Largest males (AMNH 115617-VV-2515, Eleuthera; MCZ 93340, South Bimini) 53 mm snout-vent length; largest female (MCZ 93352, South Bimini) 47 mm.

Variation. Considering the entire sample of *A. a. oligaspis* first, the snout scales between the first canthals vary between 6 and 12, the number of loreals between 21 and 44, the supraorbital semicircles are almost always (94 of 113 lizards) separated by one row of scales, modally there are 1/1 scales between the interparietal and the semicircles, and 0/0 supraorbitals in contact with the interparietal, fourth toe subdigital lamellae vary between 15 and 22, first caudal verticil median dorsal scales range from 5 to

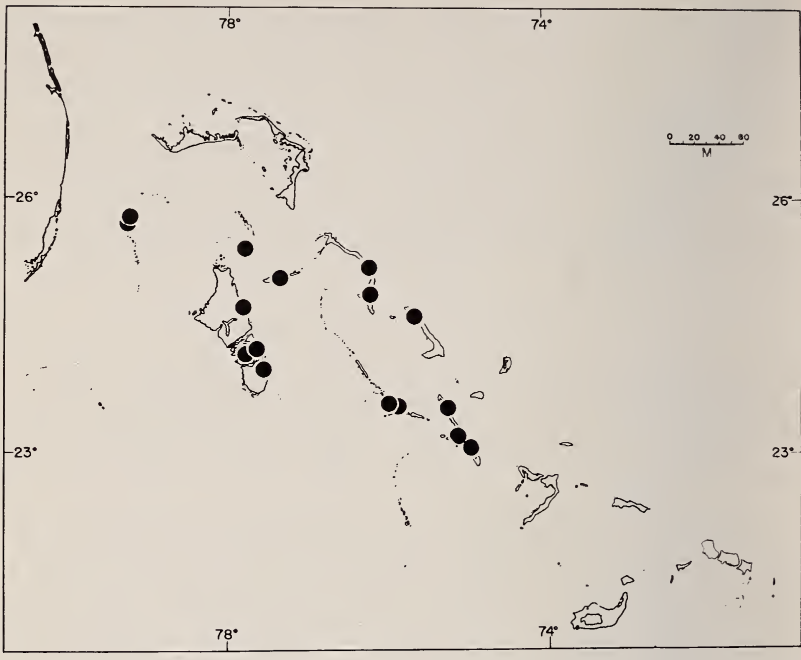

Fig. 2. Map of the Bahama Islands. Solid circles indicate stations whence *A. a. oligaspis* has been examined. Individual localities on New Providence and the Bimini Islands have not been plotted.

9, tenth caudal verticil median dorsals vary from 4 to 6, and postmentals are 4 to 8.

All Bahaman lizards have been separated into five samples on the basis of geography and for convenience of discussion; these samples are 1) North and South Bimini, the sample is composed of South Bimini lizards with one exception; 2) Andros and the Berry Islands; 3) New Providence; 4) Great Exuma, Long, Cat; 5) Eleuthera. The above survey of the characteristics of *A. a. oligaspis* can be further broken down on the basis of these samples; such a procedure is necessary to determine the status of *A. a. chickcharneyi.*

Means of snout scales between the first canthal scales vary from 8.1 (New Providence) to 9.3 (Andros, Eleuthera), with Bimini lizards having a mean of 8.4. Modes of snout scales are 7 (New Providence), 8 (bimode on Andros) or 9 (Bimini, Andros bimode, Great Exuma, Eleuthera). The Andros sample (range

7-12) includes the total range for this scale character in the entire Bahaman lot, and other samples lack only one or the other extreme.

Mean number of loreals varies from 28.9 (Bimini) to 33.9 (Eleuthera). The supraorbital semicircles are almost always separated by one row of scales; exceptions are supraorbitals in contact (13 Bimini, two Andros, two New Providence including the holotype, two Great Exuma); the only specimen from Cat Island and one from South Bimini have the semicircles separated by 2 scales.

The scales between the interparietal and the supraorbital semicircles usually are 1/1 (modal condition in Bimini, Andros, Great Exuma), but on New Providence, the nine specimens are evenly divided between the 1/1, 1/2, 2/2 categories and there is thus no mode; on Eleuthera the mode is 2/2 (six specimens) with two lizards having 1/1 and one lizard 1/2.

The number of supraorbitals contacting the interparietal is usually 0/0 (only condition observed on New Providence and Eleuthera); variants are 0/1 (three lizards), 1/1 (four), 2/2 (two) on Bimini, 0/1 (one) on Andros, 0/1 (one) on Great Exuma.

Fourth toe subdigital lamellae means vary from 18.2 (Bimini) to 19.6 (Great Exuma). Scales in the first caudal verticil have means from 5.5 (New Providence) to 6.3 (Andros) with Bimini lizards having a mean of 5.8. Means of scales in the tenth caudal verticil range from 4.7 (Great Exuma) to 5.1 (Andros).

Postmentals vary in mean from 4.7 on Bimini to 6.2 on Eleuthera, with New Providence intermediate (5.4). The modal number of postmentals is six in all populations except that on Bimini, with a mode of 4.

The recognition of *A. c. chickcharneyi* depends (Oliver, 1948) on four characters: 1) six to eight scales between the first (= seventh *sensu* Oliver) canthals, 2) 24 to 32 loreals, a number intermediate between 17 to 23 in *oligaspis* and 35 to 38 in *angusticeps*, 3) 34 to 36 lamellae on the fourth toe (a number intermediate between 33 or 34 in *angusticeps* and 36 to 40 in *oligaspis*), and 4) 4 postmentals (in contrast to 4 to 6 in *angusticeps* and 6 in *oligaspis*). We have not taken total lamellar counts on the fourth toe. There is no doubt that *A. a. oligaspis* differs (at least modally) from *A. a. angusticeps*; the status of *A. a. chickcharneyi* in relation to *A. a. oligaspis* is in question. Therefore, there is no purpose in comparing *A. a. chickcharneyi* with *A. a. angusticeps,* and we confine our comparisons of the Bimini populations with those from elsewhere in the Bahamas. Oliver was hampered in his comparisons by having very little material for comparison with his five Bimini lizards; he examined three specimens of *A. a. angusticeps* and two specimens of *A. a. oligaspis.*

Although the number of snout scales between the first canthals is not as Oliver stated (7 to 11 rather than 6 to 8), the Bimini sample does average low (8.5) in this scale feature. However, Bimini lizards are intermediate in mean number of snout scales between 8.1 (New Providence topotypes of *oligaspis*) and all other Bahaman samples (means of 9.0 to 9.3). The modal number (9) of snout scales on Bimini occurs as a bimode on Andros (8 or 9) and is also intermediate between the low mode of 7 (New Providence) and 9 (Eleuthera, Great Exuma).

Bimini lizards average less (28.9) loreals than any other population of *oligaspis* (32.1 to 33.9); the range of the Bimini loreal counts (22 to 34) is completely embraced by those of *oligaspis* from Andros (22 to 40), Great Exuma (21 to 44) and practically included by those from New Providence (24 to 37).

Fourth toe subdigital lamellae on phalanges II and III average less for the Bimini sample (18.2; range 16-21), with means for other samples varying between 18.3 (Eleuthera) and 19.6 (Great Exuma). The combined ranges of fourth toe lamellae of populations other than Bimini are 15-22, so that the counts on Bimini are included within the balance of the counts for *oligaspis.*

The Bimini sample is the only one which has 4 postmentals as the modal condition; all others have 6 postmentals modally. The Bimini mean of this character (4.7) is coordinately low compared with those of other samples (5.4 on New Providence to 6.2 on Eleuthera).

In summary, we feel that the only claim to recognition for *A. a. chickcharneyi* is the low number of postmentals. Although both the mean and mode are low in the Bimini lizards, the range of variation of "*chickcharneyi*" is enclosed by that of *A. a. angusticeps* and *A. a. oligaspis,* and virtually so by *A. a. paternus.* As far as we can determine, there are no chromatic differences between *A. angusticeps* from Bimini and elsewhere in the Bahamas.

Acceptance of *A. a. chickcharneyi* might necessitate the naming of at least one other Bahaman population, as will be discussed below, and this is a course which we are not prepared to take at this time. Considering the variation in the various samples (some admittedly small) of *A. a. oligaspis*, we feel that *A. a. chickcharneyi* does not merit recognition.

Ventral keeling in *A. a. oligaspis* is usually absent, but Hardy (1967, p. 27) noted the occurrence of keeling in a specimen from Bimini. In addition to Bimini, specimens with keeled ventrals were encountered on lizards from Andros (one with weak keeling) and Eleuthera (five of nine specimens with keeling). Keeling of the scales on the anterior face of the thigh is even more prevalent in the Bahamas; 13 specimens from Bimini, six from Andros, two from the Berry Islands, two from New Providence, one from Eleuthera, five from Great Exuma, and three from Long have some degree of keeling of the scales on the anterior face of the thigh.

Considering all of the above information, the lizards from Eleuthera are unique among *A. a. oligaspis* in that they modally have 2/2 scales between the semicircles and the interparietal (2/2 occurs only as a minor variant in all other samples) and that they include a high number of individuals with keeled ventral scales. Eleuthera *oligaspis* also have a high mean number of scales between the first canthals (9.3, which is also the mean on Andros), the highest mean (33.9) number of loreals, always have the semicircles separated by one row of scales (a feature which is not constant in any other sample of *A. angusticeps* throughout its range), and have the highest mean (6.2) of postmental scales. Increasing familiarity with the Bahaman herpetofauna makes it clear that reptiles on Eleuthera have a strong tendency to differ from their relatives elsewhere in the Bahamas. In two instances (*Sphaerodactylus decoratus*, Thomas and Schwartz, 1966; *Anolis distichus* Schwartz, 1968a) the Eleuthera populations have reached a level of subspecific difference from the balance of the Bahaman populations.

If we accept *A. a. chickcharneyi* as a valid subspecies, we would be reluctant to leave the Eleuthera *A. angusticeps* unnamed. Eleuthera lizards differ more from *A. a. oligaspis* than do Bimini lizards. However, the small series of *A. angusticeps* from Eleuthera causes us to be circumspect; we regard all Bahaman populations as *A. a. oligaspis*.

Comparisons: *A. a. oligaspis* differs from *A. a. angusticeps* and *A. a. paternus* in several scale characters. The higher number of snout scales between the first canthals (3-10 in *angusticeps*, 3-8 in *paternus*, 7-12 in *oligaspis*), and the greater number of scales in the first caudal verticil (4-7 in *angusticeps* and *paternus*, with means by area from 4.6-5.4; 5-9 in *oligaspis* with means by island between 5.5 and 6.3) are distinctive. The usually smooth head scales in both sexes of *oligaspis* serve also to distinguish the subspecies from both *angusticeps* and *paternus*.

Dorsal color and pattern of *A. a. oligaspis* is variable. Notes taken on two living specimens will serve to demonstrate this variability; 1) ASFS V7241, female, dorsal ground color gray with a series of transverse black markings in the style of crossbars but only irregularly so; a pair of pale gray dorsolateral lines; posterior dorsum suffused with rich wood brown; tail banded gray and black; 2) ASFS V6803, female, dorsal ground color brown with yellow longitudinal striae on flanks superimposed on brown bars on a gray ground; color when caught gray with dark mottlings. Males tend to lack the dorsolateral lines ascribed to the females noted above, but in some color phases males have these lines. In some phases, there is also a black, butterfly-shaped lumbar spot. Dewlaps of *A. a. oligaspis* have been recorded in life as Pl. 10 C 6 (pale peach) on Great Exuma, Pl. 2 A 10 (peach) on South Bimini, and Pl. 9 B 7 and 9 C 7 (dark peach) on South Bimini. Although there is no evidence that *A. a. oligaspis* shows variation in dewlap color comparable to that of *A. a. angusticeps*, our data for the Bahaman subspecies are too limited to be conclusive.

Specimens examined. Bahama Islands, North Bimini, Alicetown, 1 (MCZ 46066); *South Bimini,* 1 mi. S Alicetown (North Bimini), 6 (UF/FSM 16602-07); west end, 9 (ASFS V2448, CM 32553, CM 32600, AMNH 68616-17, AMNH 68619-20, MCZ 49736, MCZ 93334); northeastern part, 2 (ASFS V10752-53); near Nixon's Harbour, 1 (CM 32616); road to Nixon's Harbour, west end, 3 (MCZ 93335-37); road to airport, west end, 2 (MCZ 93338-39); 1 to 1.5 mi. SSE northwest point, 16 (MCZ 93340-43, MCZ 93345-46, MCZ 93354-61, MCZ 93365-66); 1.5 mi. S northwest point, 1 (MCZ 93344); 0.5 to 1.5 mi. SSE northwest point, 5 (MCZ 93347-51); 0.75 to 1 mi. WNW airstrip, 2 (MCZ 93352-53); 1 mi. SSE northwest point, 3 (MCZ 93362-64); no data other than South Bimini, 7 (ASFS V7116-

19, MCZ 80129-31); no data other than "Bimini Island" or "Bimini", 2 (UMMZ 118302, UF/FSM 7711); *Andros*, Fresh Creek, Coakley Town, 1 (MCZ 41990); Little Creek, 2 (UMMZ 118010); Lisbon Creek shore, 1 (AMNH 76312); Bastian Point, 2 (AMNH 76310-11); Mangrove Cay, 11 (AMNH 74487-96, UMMZ 109221); no data other than Andros Island, 1 (USNM 49533); *Berry Islands*, Frazer's Hog Cay, near center of northeastern arm, 2 (ASFS V10669-70); *New Providence* (localities not mapped), 7 mi. W Nassau, 1 (AMNH 76306); Cave Point, 1 (ASFS 10304); 4.8 mi. SW Cave Junction, 3 (ASFS V10379-81); Yamacraw Beach, 1 (ASFS V10359); 0.6 mi. NW Yamacraw Beach, 1 (ASFS V7241); 0.3 mi. E Nassau East, 1 (ASFS V10733); data from ANSP 26119, holotype of *A. a. oligaspis* included in analysis; *Eleuthera*, Rock Sound, 8 (UMMZ 115617); between Governor's Harbour and Savannah Sound, 1 (ASFS V6803); *Great Exuma*, 3.2 mi. NW George Town, 7 (ASFS V7028-30, ASFS V7063-66); Bahama Sound, southwest of The Forest, 3 (ASFS V7097-99); *Long Island*, 4.2 mi. S Adderleys, 1 (ASFS V10824); Deadman's Cay Settlement, 2 (AMNH 76307-08); Clarence Town, 4 (MCZ 38016, MCZ 42288-90); *Cat Island*, Bennett's Harbour, 1 (AMNH 76309).

HABITAT NOTES

Anolis angusticeps is not so often encountered in the field as are many less cryptic anoles. For this reason, its habitat has not been well defined. Collette (1961) recorded *A. angusticeps* as a primarily tree trunk frequenter in a wooded area near La Habana, and Ruibal (1964) considered it to be a lizard of "open habitats: fence posts, rocks, palm trunks, . . ." Others (Alayo, 1955; Buide, 1966) have noted its occurrence in coastal sea grape (*Coccoloba*) situations. Hardy (1967, p. 30) stated that most of the type series of *A. a. paternus* was taken in grassy meadowland; a few more were found on the trunks of royal palms. In the Bahamas, Oliver (1948) observed *A. angusticeps* relatively high (6 to 25 feet) in light-barked trees.

Our own observations in Cuba encompass all of the above observations for that island. Specimens on which habitat notes were taken were found on shrubs and grass (2), rocks (4), fence post in pasture (1), ground (1), trees, including coastal *Coccoloba* and *Terminalia* (3). On the Isla de Pinos one specimen was found on a shrub in a pasture.

In the Bahamas *A. angusticeps* appeared to us to be a more confirmed tree dweller. Most of our specimens were taken at night while they slept on small diameter branches and twigs relatively high off the ground (6 to 12 feet) in well developed coppice growth (Bahaman coppice at best is distinctly lower than most wooded situations in Cuba). During the day one was taken on a barbed-wire fence (on the wire) adjacent to woods on New Providence and another on a sea grape tree near the coast. On Eleuthera a single specimen was taken on a sloping tree trunk about eight feet above the ground (day). In the Berry Islands (Frazer's Hog Cay) three were observed in the tops of *Bursera* and *Lysiloma* saplings 8 to 9 feet above the ground during the heat of the day. On Long Island a single lizard was found in daylight about five feet above the ground on a small sapling in a patch of tamarind trees. However, Mr. Thomas W. Schoener, who observed and collected anoles on Bimini, was able with close observation to find *angusticeps* more commonly than have other observers. He also found that it occurred on vegetation near the ground as well as high in trees.

The habit of this anole of remaining motionless, often adpressing itself to its resting place in order to evade notice, has been remarked upon (Buide, 1966; Garrido and Schwartz, MS; Collette, 1961). The often lichenate coloration and low profile of this lizard make it particularly difficult to see in such circumstances.

Anolis angusticeps sleeps lengthwise along a small branch, twig, or vine; the tail is extended posteriorly and the distal portion curled loosely about the supporting object. This sleeping posture is virtually identical to that of the recently described *A. occultus* of Puerto Rico (Thomas, 1965); the sleeping site of the two species is very similar, but *A. angusticeps* is broader in tolerance of size and kind of sleeping surface and height above the ground. (*A. occultus*, it should be noted, is an inhabitant of montane rainforest canopy in contrast to the more xenotopic *angusticeps*). In gross aspect (short tail and limbs, long body, large head) and general coloration the two species are remarkably similar. One of the more notable coloration resemblances is the presence of a dark lumbar spot in some color phases of both species.

We do not suggest that *angusticeps* and *occultus* are close relatives. Williams and Rivero (1965) have discussed the affinities of *occultus*, which does not seem to lie with any Antillean species. We merely wish to point out a remarkable similarity. As a matter of fact, the distantly related *A. valencienni* of Jamaica is also of this adaptive style and is in proportions and coloration generally similar to *angusticeps*. It too has the habit of pressing closely to the substrate to escape notice (Underwood and Williams, 1959).

In summary we feel that *A. angusticeps* is a cryptic tree anole whose means of evading capture lies primarily in protective coloration and slow movements (as opposed to a cursorial tree anole such as *A. distichus*, which depends much upon speed to evade capture and which is much more in evidence). The possibility that Cuban and Isla de Pinos *A. angusticeps* are less arboreal than the Bahaman ones needs further investigation. Part of the reason that *A. angusticeps* has not been more often observed high in trees in Cuba may be the difficulty of seeing the individuals at all at any distance in natural surroundings.

DISCUSSION

Anolis angusticeps is one of a group of reptiles (*Sphaerodactylus notatus, Sphaerodactylus decoratus, Leiocephalus carinatus, Ameiva auberi*) whose range is primarily Cuba and the Bahama Islands. According to Schwartz (1968b) these animals are part of a relatively recent group of invaders from Cuba whose Bahaman distribution is in most cases restricted to the islands of the Great Bahama Bank. Other Cuban amphibians and reptiles (*Hyla septentrionalis, Eleutherodactylus planirostris, Tarentola americana, Anolis carolinensis, Anolis sagrei, Typhlops biminiensis*) show related patterns of distribution.

From a Cuban center of origin, *A. angusticeps* reached both the Isla de Pinos and the Bahama Islands. Since some lizards from Pinar del Río Province in western Cuba still show at least one *A. a. paternus* character (ventral keeling) to some degree, we consider that *A. a. paternus* has been only recently divided from *A. a. angusticeps*. Cuba and the Isla de Pinos are separated by the shallow (18 meters) Golfo de Batabanó. It seems likely that, when the Isla de Pinos and Cuba were a single unified land mass (a condition which has probably occurred numerous times in the past, since even relatively slight fluctuations in sea level will unite the two land masses) a more or less continuous population of *A. angusticeps* occurred from the Isla de Pinos to Oriente Province. In such a population, the southwestern (Isla de Pinos) lizards developed keeled scales; some scale characters in this continuous population were clinal from southwest to east (snout scales between first canthals, postmentals, contact of supraorbital semicircles). With the separation of the Isla de Pinos from Cuba, *A. angusticeps* of the latter have been separated from the remainder of the cline and their characters have been fixed. Remnants of the older association are still retained by *A. angusticeps* in Pinar del Río.

On the Great Bahama Bank, the trend has been toward greater number of postmentals, greater number of scales in the caudal verticils, slightly higher number of loreals, and more scales between the first canthals. Of these, the last is most conspicuous. Some trends in the Bahaman populations have occurred *in situ* on these islands; the high incidence of ventral keeling in Eleuthera *A. a. oligaspis* is a concrete example. There are also variations in some scale characters (scales between the first canthals, scales between the semicircles and the interparietal) which occur geographically in a rather haphazard manner. These differences between the Great Bank populations of *A. angusticeps* suggest that an active differentiation has taken place on several of the islands, but in no case in our opinion has this differentiation gone so far as to be acknowledged nomenclatorially.

It is instructive to compare *A. angusticeps* with another recent anoline invader of the Bahamas—*Anolis distichus* from Hispaniola. Not only has this species evolved a series of subspecies on its parent island (whereas *A. angusticeps* has not), but *A. distichus* has a series of six Bahaman subspecies. The ranges of the two lizards are comparable, except that *A. distichus* has reached two islands (Rum Cay, San Salvador) which are off the Great Bank and which together are inhabited by one of the six Bahaman races. The subspecies of *A. distichus* are easily characterized by head scalation, dewlap color, and body pattern and color. The differences between *A. distichus* and *A. angusticeps* may be attributable to more ancient arrival in the Bahamas of *A. distichus*. There is also the possibility, supported by some evidence in other species, that a cryptic, bark anole (as opposed to more cursorial ones) is less liable to great color variation, presumably because of selective pressure to maintain the successful protective coloration.

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