

The anoles (genus *Norops*) of Guatemala.

I. The species of the Pacific versant below 1500 m elevation

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Abstract

Based on differences in hemipenis morphology *Norops sericeus* is considered to be a composite of at least two species, one of which occurs along the Pacific versant of Central America and the other along the Caribbean versants of Mexico and Central America. *Norops cristifer*, formerly considered to be a subspecies of *N. pentaprion*, is elevated to species status based on differences in scalation (adult males of *Norops cristifer* have a well-developed a serrated mid-dorsal crest formed by a single row of enlarged spine-like scales whereas in *N. pentaprion* there is always a double-row of slightly enlarged mid-dorsal scales, but no serrated crest present) and body size (*N. cristifer* to 88 mm SVL; *N. pentaprion* to 79 mm SVL). Seven species of *Norops* are known to occur along the Pacific versant of Guatemala below 1500 m elevation (*N. cristifer*, *N. dollfusianus*, *N. laeviventris*, *N. macrourus*, *N. petersii*, *N. sericeus* complex (Pacific versant), and *N. serranoi*); a key to these species is provided. Summaries of individual variation (body proportions, scalation, hemipenis morphology, and colour pattern), geographic distribution, and figures as well as some natural history notes are provided for five of these species (*N. laeviventris* and *N. petersii* will be included in a forthcoming part of this series). Usually several (up to four) of these species occur sympatrically.

Key words: Squamata: Iguanidae: *Norops*; Pacific versant Guatemala.

1 Introduction

The history of research on Guatemalan anoles dates back to at least the early nineteenth century. WIEGMANN (1834) described two widespread species that also occur in Guatemala (i. e., *Norops biporcatus*, *N. laeviventris*). Many of the anole species that are still considered to be valid and occur in Guatemala were described during the following 50 years, such as *N. sericeus* (HALLOWELL, 1856), *N. lemurinus* (COPE, 1861), *N. pentaprion* (COPE, 1862), *N. tropidonotus* (PETERS, 1863), *N. capito* (PETERS, 1863), *N. crassulus* (COPE, 1864), and *N. uniformis* (COPE, 1885). Additional members of this large genus were described by BOUCOURT (in DUMÉRIL et al. 1870-1909), including *N. bouvierii*, *N. dollfusianus*, *N. petersii*, *N. rodriguezii* (all originally assigned to the genus *Anolis*). In his “Catalogue of the lizards in the British Museum”, BOULENGER (1885) described *Anolis salvini*, a species still only known from the holotype. In his classical treatment of the herpetofauna of Mexico and Central America, GÜNTHER (1885-1902) listed 16 species as known for Guatemala and Belize, some of which are currently not considered to be members of the Guatemalan herpetofauna (e. g., *N. ortonii*) or are considered invalid species today (e.g., *N. copii*, *N. godmani*). In 1917, WERNER described *Anolis macrourus*, a taxon that remained in the synonymy of *N. cupreus* for most of the 20th Century (however, some authors considered it to be a subspecies of the latter species). SLEVIN (1942) reported upon the results of a collection of lizards (including anoles) made in Guatemala in 1924 and 1926. Anoles greatly interested the late LAURENCE C. STUART. During his extensive field work in Guatemala, STUART gathered important data on the distribution of Guatemalan anoles and described four new species (i. e., *Anolis ruthveni*, *A. cobanensis*, *A. haguei*, and *A. cortesi*; STUART 1935, 1942). In 1955, STUART published “A brief review of the Guatemalan lizards of the genus *Anolis*” recognizing “21 forms of the genus”. In 1970, the

“Catalogue of Neotropical Squamata” appeared (PETERS & DONOSO-BARROS 1970). This important work contains the most recent checklist with synonymies of the anoles of Central and South America. Recent contributions on Guatemalan anoles have been fewer still. CAMPBELL & VANNINI (1989) published a checklist of the herpetofauna of Guatemala and in CAMPBELL (1998) are summaries of description, natural history and distribution of nine species of *Norops* from northern Guatemala and Belize. Recently, KÖHLER (1999) described the Pacific versant populations of northern Central America and Mexico of anoles formerly assigned to *N. lemurinus* as a new species, *N. serranoi*. KÖHLER & KREUTZ (1999) resurrected *Norops macrophallus* (WERNER, 1917) from the synonymy of *N. cupreus*.

Existing uncertainties of geographical and morphological species boundaries of Guatemalan anoles have prompted us to begin with a study on the variation and taxonomy of the genus *Norops* in this Central American country.

This work is intended to be published as a series of papers, the present one dealing with the species of anoles known to occur along the Pacific versant of Guatemala below 1500 m elevation. The second paper in this series will be on the species inhabiting mainly or exclusively the highlands (above 1500 m elevation) of the country, and the third paper will treat the species that are known to occur on the Atlantic versant. Two species that occur on both versants of Guatemala (i. e., *Norops laeviventris*, *N. petersii*) are included in the identification key, but will be treated in detail in a following part of this series, mostly because of lack of sufficient material at this point. The status of two problematic Guatemalan taxa (*Anolis bouvierii* BOOCOURT, 1873 and *Anolis salvini* BOULENGER, 1885) will be discussed in a forthcoming part of this series.

2 Materials and Methods

The data on which this study is based were obtained from preserved anoles housed in various collections and data gathered during field work in Guatemala in the past ten years (M.A.) and during an expedition in March / April 2003 (M.A. and G.K.). The keys and descriptions are based on specimens examined by the authors and refer exclusively to Guatemalan material. Measurements and scalation data were taken from ten males and ten females of each species except for *Norops cristifer* (only three males and two females available for our study). Colour descriptions refer to specimens in life if not otherwise specified. Abbreviations for museum collections follow those of LEVITON et al. (1985), except USAC (Universidad de San Carlos de Guatemala, Guatemala City). Data for anoles whose collecting site was recorded using the UK and US systems of linear measure have been converted to metric equivalents. We follow GUYER & SAVAGE (1987, 1992) in recognizing the genus *Norops* for the beta anoles (sensu ETHERIDGE 1959). Nomenclature of scale characters follows that of KÖHLER (2003). Terminology for hemipenial morphology follows that of MYERS et al. (1993) and SAVAGE (1997). Ear opening and scale sizes were measured using the ocular micrometer of a stereo microscope (Leica MZ 12) and were rounded to the nearest 0.01 mm; all other measurements were made using precision calipers and were rounded to the nearest 0.1 mm. Head length was measured from the tip of the snout to the anterior margin of the ear opening. Snout length was measured from the tip of the snout to the anterior border of the orbit. Head width was determined as the distance between the oral ricti. Dorsal and ventral scales were counted at midbody along the midline. Tail height and width were measured at the point reached by the heel of the extended hind leg. Subdigital lamellae were counted on phalanges II to IV of the 4th toe.

3 Results

The status of the Pacific versant populations of Mexican and Guatemalan anoles formerly referred to *Norops* (or *Anolis*) *pentaprion*

In 1968, based on a single specimen (UIMNH 37066) from near Acacoyagua, Chiapas, Mexico, SMITH described the new taxon *cristifer* as a subspecies of *Anolis pentaprion*. Since its original description this taxon has received little attention and subsequent authors have mostly treated it as a subspecies of *Norops* (or *Anolis*) *pentaprion* (e. g., LIEB 1995, 2001). Without further comments KÖHLER (2003) treated *N. cristifer* as a valid species rather than a subspecies of *N. pentaprion*. The decision to consider *cristifer* and *pentaprion* as separate species is based on obvious difference in scalation and body size. Adult males of *Norops cristifer* have a well-developed serrated mid-dorsal crest formed by a single row of enlarged spine-like scales whereas in *N. pentaprion* there is always a double-row of slightly enlarged mid-dorsal scales, but no serrated crest present (these differences are illustrated in KÖHLER 2003: 118). *Norops cristifer* (SVL to 88 mm) is a much larger species than *N. pentaprion* (SVL to 79 mm). The geographic distribution of both species shows an allopatric pattern: *N. cristifer* occurs on the Pacific versant in eastern Chiapas, Mexico, and western Guatemala whereas in Mexico and northern Central America *N. pentaprion* is restricted to the Caribbean versant LIEB 1995, 2001, KÖHLER 2003). Based on this evidence, we formally assign species status to *Norops cristifer*.

Key to the species of *Norops* known to occur on the Pacific versant of Guatemala below 1500 m elevation

- 1 a. Short-legged (ratio shank length/SVL usually < 0.25; 4th toe of adpressed hindlimb reaches usually to a point between shoulder and ear opening, in some individuals to point between ear opening and eye) 2
- 1 b. Long-legged (ratio shank length/SVL usually > 0.25; 4th toe of adpressed hindlimb reaches at least to posterior border of eye) 5
- 2 a. Ventral scales strongly keeled, imbricate and mucronate; SVL to 55 mm 3
- 2 b. Ventral scales smooth or only slightly keeled with rounded posterior margins; SVL of adults > 55 mm 4
- 3 a. 2-3 overlapping anterior superciliaries of various sizes present; lateral body scales usually heterogeneous, solitary enlarged keeled or elevated scales (often whitish) scattered among smaller (mostly granular) laterals; males usually with enlarged postanal scales; male dewlap dirty white *Norops laeviventris*
- 3 b. A single conspicuously large and elongate anterior superciliary present; lateral body scales homogeneous, no solitary enlarged keeled or elevated scales scattered among smaller (mostly granular) laterals; males without enlarged postanal scales; male dewlap yellowish orange with large blue or purple blotch (Fig. 1d) ***Norops sericeus* complex (Pacific versant)**
- 4 a. A dorsal row of enlarged median crest scales on posterior portion of trunk; suboculars and supralabials in contact; ventral scales rounded and convex, non-imbricate, smooth *Norops cristifer*

- 4 b.** No dorsal row of enlarged median crest scales on posterior portion of trunk; suboculars and supralabials separated by one scale row; ventral scales flat and slightly keeled, semi-imbricate *Norops petersii*
- 5 a.** SVL of adults 60-80 mm; subdigital lamellae of 4th toe 25-33; dorsum often with dark brown broad transverse bands; often with a lyriform marking in nuchal region *Norops serranoi*
- 5 b.** SVL of adults < 50 mm; subdigital lamellae of 4th toe 19-25; no dark brown broad transverse bands on dorsum; no lyriform marking in nuchal region **6**
- 6 a.** A single large superciliary; a single prenasal scale; suboculars and supralabials usually in contact; 0-1, rarely 2, scales separating supraorbital semicircles at narrowest point; dewlap of adult males yellow (Fig. 1a) *Norops dollfusianus*
- 6 b.** Two large, overlapping superciliaries; prenasal divided into a upper and a lower scale; suboculars and supralabials usually separated by one complete scale row; 2-3 scales separating supraorbital semicircles at narrowest point; dewlap of adult males rose with an orange yellow basal blotch (Fig. 1b) *Norops macrourus*

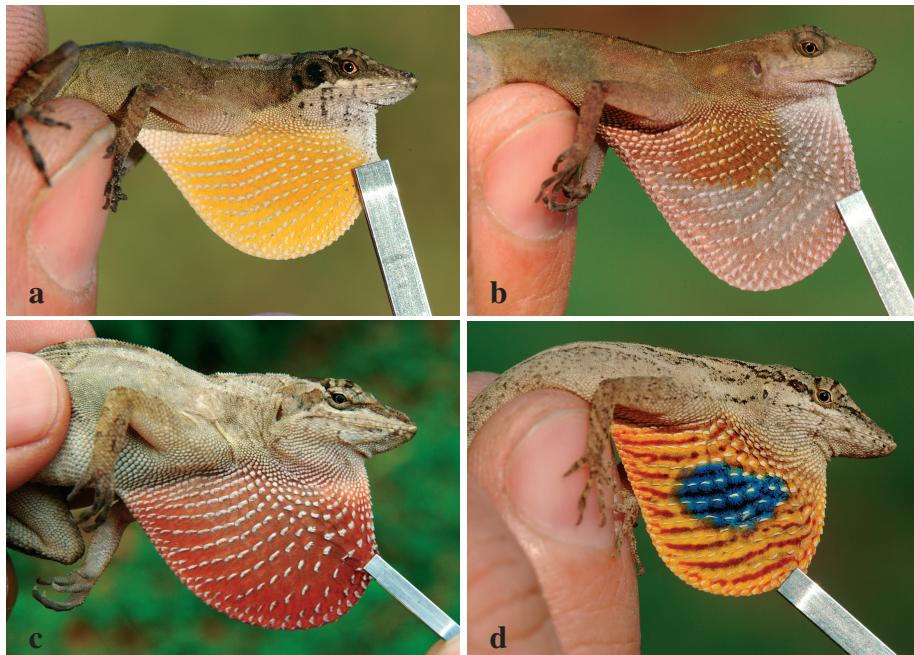


Fig. 1. Males with extended dewlaps / Männchen mit aufgespreizten Kehlfahnen. a) *Norops dollfusianus* (SMF 82579); b) *N. macrourus* (SMF 82605); c) *N. serranoi* (SMF 82564); d) *N. sericeus* complex (Pacific versant) (SMF 82669).

***Norops cristifer* (SMITH, 1968)**

1968 *Anolis pentaprion cristifer* SMITH, Trans. Kansas Acad. Sci. 71: 195; type locality: vicinity of a small lake near Acacoyagua, Chiapas, Mexico.

Distribution: Pacific versant in eastern Chiapas, Mexico, and western Guatemala (Fig. 2).

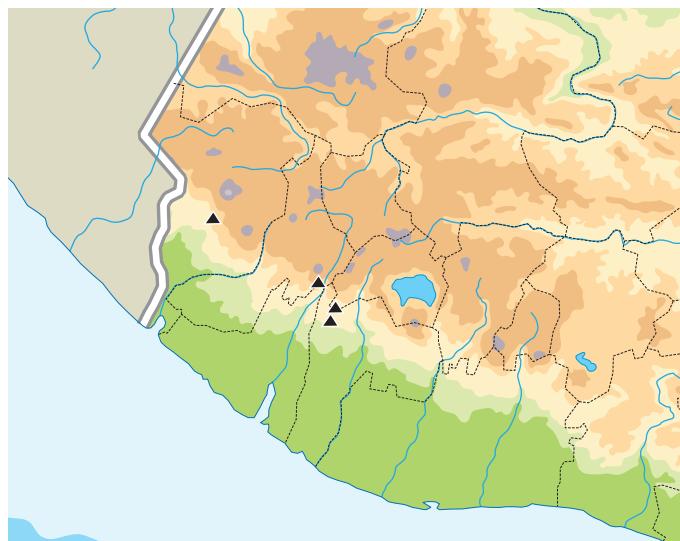


Fig. 2. Distribution of / Verbreitung von *Norops cristifer* in Guatemala.

Diagnosis: A large species of *Norops* that can be distinguished from all other Guatemalan species of the genus except *N. pentaprion* by (1) having extremely short hind legs (4th toe of adpressed hindlimb usually failing to reach level of shoulder; ratio tibia length / head length 0.68-0.75); (2) smooth, juxtaposed ventral scales; (3) a very short tail (ratio tail length / SVL 1.31-1.38). *Norops cristifer* differs from *N. pentaprion* by having a serrated middorsal crest, at least on posterior portion of dorsum (versus a double row of slightly enlarged middorsal scales, not forming a serrated crest in *N. pentaprion*).

Description (Fig. 3): Maximum SVL 88 mm in males, 75 mm in females; tail length / SVL ratio 1.31-1.38; tail slightly vertically oval in cross section, tail height / width ratio 1.1-1.2 longest toe of adpressed hind limb usually failing to reach level of shoulder; scales on snout mostly smooth, some rugose; 6-8 postrostrals; 6-7 scales between nasals; 2 scales between circumnasal and rostral; 4-5 prenasal scales in a recurved series with the lowest prenasal scale contacting the first supralabial; scales in indistinct frontal depression mostly smooth, some rugose; supraorbital semicircles well developed, composed of mostly smooth scales; 1-2 rows of scales separating supraorbital semicircles at narrowest point; 2-4 rows of scales separating supraorbital semicircles and interparietal at narrowest point; supraorbitals composed of 5-8 slightly enlarged, flat smooth scales; enlarged supraorbitals separated from supraorbital

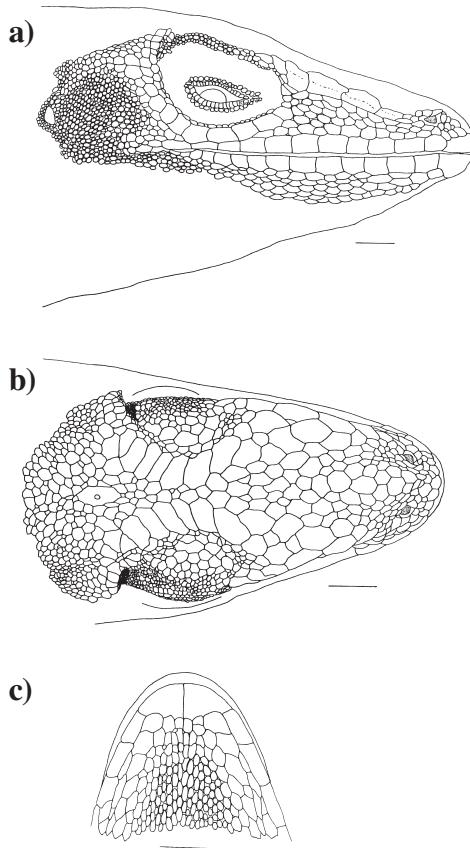


Fig. 3. Head of *Norops cristifer* (CAS 68214).
a) lateral view; b) dorsal view; c) ventral view.
Scale bars equal 1.0 mm.

Kopf von *Norops cristifer* (CAS 68214). a)
Lateralansicht; b) Dorsalansicht; c) Ventralan-
sicht. Balken = 1,0 mm.

semicircles by a complete row of small scales; supraorbitals decreasing gradually in size laterally; 4-5 rows of granular scales between enlarged supraoculars and superciliaries at level of mid-orbit; 2-3 slightly enlarged, not particularly elongated non-overlapping superciliaries, followed by small granular scales posteriorly; interparietal scale well developed, markedly enlarged relative to adjacent scales; surrounded by scales of moderate size; canthal ridge distinct, composed of 3-5 large posterior and 3-4 small anterior scales; 7-8 scales present between second canthals; 9-10 scales present between posterior canthals; loreal region slightly concave, about 25-43 mostly smooth (some rugose) loreal scales in a maximum of 4-6 horizontal rows; mostly smooth (some rugose) subocular scales arranged in a single row; 9-11 supralabials to level below center of eye; 3-5 suboculars in contact with supralabials; mental completely divided medially, bordered posteriorly by 4-6 postmentals with the outer postmental scale on each side not greatly enlarged, their lengths less than the length of the mental scale; 8-10 infralabials to level below center of eye; sublabials undifferentiated; smooth granular scales present on chin and throat; lateral head scales anterior to the ear opening slightly larger than those posterior to the ear opening; ear opening round to slightly vertically oval, ratio ear opening height / interparietal length 1.8-1.9; dorsum of body with small, juxtaposed convex scales, 34-48 middorsal dorsal scales in one head length; middorsal row distinctly enlarged, forming a serrated

crest (best developed in large males), at least on posterior portion of dorsum; in some individuals (especially females), on anterior portion of dorsum two median rows are slightly enlarged, the rest of dorsals gradually grading into the granular and homogeneous laterals; ventrals at midbody smooth, juxtaposed and convex; 40-56 ventral scales in one head length; dorsal medial caudal scales strongly enlarged, forming a serrated crest; lateral caudal scales heterogeneous, with a distinct division in segments, usually three dorsal and three ventral scales per caudal segment; two rows of subcadal rows greatly enlarged and strongly keeled; adjacent ventrolateral scale row with slightly smaller scales that are strongly keeled and forming a strong ventrolateral ridge; no enlarged postanal scales in males; tube-like axillary pocket absent; limb scales smooth, subimbricate; digital pads dilated, about three to four times as wide as non-dilated distal portion of toe; distal phalanx narrower than and raised from, dilated pad; 30-35 lamellae under phalanges II-IV of 4th toe; 6-8 scales under distal phalanx of 4th toe.

Data on hemipenis morphology are not available.

Dorsal surfaces of head, body and tail greyish brown; dorsum with numerous indistinct small pale brown blotches resulting in a lichenous pattern; ventral surfaces of head, body and tail cream or dirty white; tail with indistinct dark brown cross bands. Data on colouration of dewlap are not available.

Natural History notes: M.A. has collected a female of *Norops cristifer* (SMF 82593) at circa 500 m elevation. The female was observed on an orange tree (together with an adult male) in an open area close to the main house of Finca El Patrocinio.

Specimens examined: QUETZALTENANGO: El Palmar, Palajunoj, Finca El Patrocinio: SMF 82593; SAN MARCOS: Hacienda California: MCZ 29771; SUCHITEPEQUEZ: Mazatenango: CAS 68214-15; Volcán Zunil: CAS 68216.

Norops dollfusianus (BOCOURT, 1874)

1874 *Anolis dollfusianus* BOCOURT, Miss. Sci. Mex., Rept. "1873" (1874): 84; type locality: Volcán Atitlán, Guatemala, 1200 m elevation.

Distribution: Pacific versant of eastern Chiapas, Mexico, and western Guatemala (Fig. 4).

Diagnosis: A small species of *Norops* that can be distinguished from all other Guatemalan species of the genus except *N. rodriguezii* by the combination of having (1) long hind legs (4th toe of adpressed hindlimb reaches at least to posterior border of eye; ratio tibia length / head length 0.89-1.10); (2) keeled ventral scales; (3) no enlarged postanal scales in males; (4) no tube-like axillary pocket; and (5) a single prenasal scale. *Norops dollfusianus* differs from *N. rodriguezii* in dewlap colour (uniform yellow in *N. dollfusianus* versus orange with darker basal area in *N. rodriguezii*), snout shape (straight in lateral view in *N. dollfusianus* versus concave in *N. rodriguezii*), number of middorsal scales between levels of axilla and groin (59-66 in *N. dollfusianus* versus 91-107 in *N. rodriguezii*), and by having an unilobate hemipenis (bilobate in *N. rodriguezii*).

Description (Figs. 5, 6): Maximum SVL 39 mm in males, 42 mm in females; tail length / SVL ratio 1.76-2.00; tail almost rounded in cross section, tail height / width ratio 0.8-0.9; longest toe of adpressed hind limb usually reaching to a point between posterior and anterior margin of eye; scales on snout strongly keeled; 4-6 postrostrals; 6-8 scales between nasals; one scale between circumnasal and rostral; a single prenasal scales contacting both the first supralabial and the rostral; scales in distinct frontal

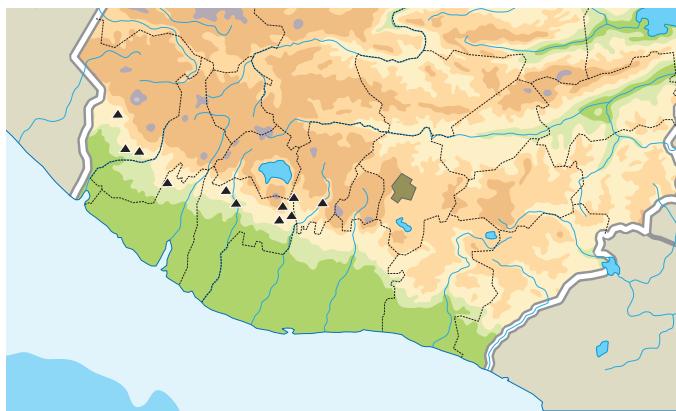


Fig. 4. Distribution of / Verbreitung von *Norops dollfusianus* in Guatemala.

depression strongly keeled; supraorbital semicircles well developed, composed of keeled scales; 0-1, rarely two, rows of scales separating supraorbital semicircles at narrowest point; 1-3, rarely four, rows of scales separating supraorbital semicircles and interparietal at narrowest point; supraorbitals composed of 6-13 distinctly enlarged,

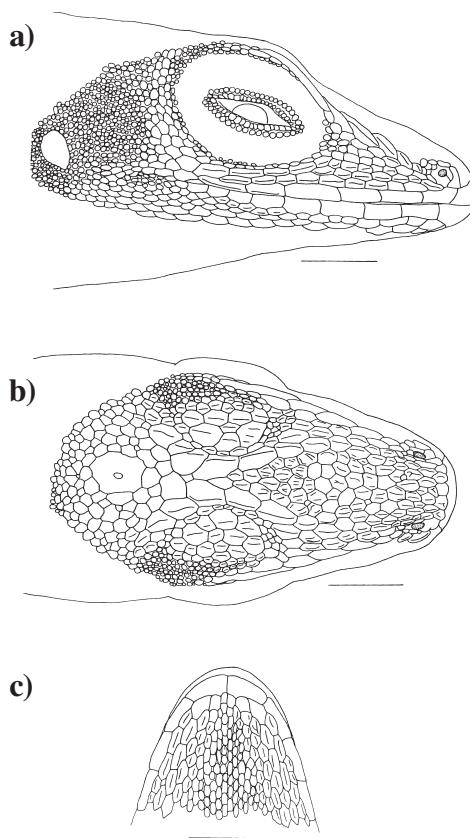


Fig. 5. Head of *Norops dollfusianus* (SMF 82579). a) lateral view; b) dorsal view; c) ventral view. Scale bars equal 1.0 mm.

Kopf von *Norops dollfusianus* (SMF 82579).
a) Lateralansicht; b) Dorsalansicht; c) Ventralansicht. Balken = 1,0 mm.

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Fig. 6. Adult male of *Norops dollfusianus* (SMF 82580). SVL 39.0 mm.

Adultes Männchen von *Norops dollfusianus* (SMF 82580). KRL 39,0 mm.

strongly keeled scales; 1-2 enlarged supraorbitals in contact with supraorbital semi-circles or all separated by a complete row of small scales; supraorbitals decreasing abruptly in size laterally; 2-4 rows of granular scales between enlarged supraoculars and superciliaries at level of mid-orbit; usually a single elongated supraciliary



Fig. 7. Habitat of / Lebensraum von *Norops dollfusianus* at / bei Reserva Natural Los Tarrales, 950 m.

(occasionally followed by an additional but much shorter elongate scale posteriorly), followed by small granular scales posteriorly; interparietal scale well developed, markedly enlarged relative to adjacent scales; surrounded by scales of moderate size; canthal ridge distinct, composed of three large posterior and 3-5 small anterior scales; 6-11 scales present between second canthals; 10-13 scales present between posterior canthals; loreal region slightly concave, about 24-44 keeled loreal scales in a maximum of 5-6 horizontal rows; keeled subocular scales arranged in a single row; 5-7 supralabials to level below center of eye; 1-3 suboculars in contact with supralabials; mental completely divided medially, bordered posteriorly by 6-8 postmentals with the outer postmental scale on each side not greatly enlarged, their lengths less than the length of the mental scale; 5-7 infralabials to level below center of eye; sublabials undifferentiated; keeled granular scales present on chin and throat; lateral head scales anterior to the ear opening about the same size as those posterior to the ear opening; ear opening vertically oval, ratio ear opening height / interparietal length 0.5-0.9; dorsum of body with small, flattened, keeled scales, 34-50 dorsal scales in one head length; about 2-4 median rows slightly enlarged, the rest of dorsals gradually grading into the granular and homogeneous laterals; ventrals at midbody distinctly keeled, usually with rounded posterior margins and subimbricate; 28-42 ventral scales in one head length; dorsal, lateral and ventral caudal scales strongly keeled; dorsal medial caudal scales slightly enlarged, not forming a crest; no enlarged postanal scales in males; tube-like axillary pocket absent; limb scales keeled, imbricate; digital pads dilated, about twice as wide as non-dilated distal portion of toe; distal phalanx narrower than and raised from, dilated pad; 19-25 lamellae under phalanges II-IV of 4th toe; 5-7 scales under distal phalanx of 4th toe.

The completely everted hemipenis (SMF 82583) is a small unilobate organ with a pointed apex; sulcus spermaticus bordered by well developed sulcal lips, opening at base of apex into a broad slightly concave area; no particular surface structure is discernable except for small fold on the asulcate surface of apex and distal truncus.

Dorsal surfaces of head, body, forelimbs and tail greyish to yellowish brown; dorsal surface of hind limbs like dorsum or orange; limbs usually with some indistinct pale brown transverse or oblique stripes; ventral surfaces of head, body, and tail dirty white; tail only faintly banded. Dorsum of males either without pattern, with narrow dark brown chevrons, or with small vertebral x-shaped markings. The colour pattern of adult females is much more variable than that of adult males. There are four main pattern types with many intermediate or combinations: (1) dorsum uniformly greyish to yellowish brown without a specific pattern; (2) dorsum with a broad cream-coloured dorsal stripe, narrowly edged with dark brown or black; (3) dorsum with a longitudinal series of diamond shaped mid-dorsal marks (usually the marks overlap, so that the posterior corner of one merges with the anterior part of the next); (4) dorsum with a series of transverse dark brown chevrons. Male dewlap in life yellow.

Natural History notes: *Norops dollfusianus* occurs at elevations mostly between 800 m and 1510 m (exceptionally also at lower elevations) in non-disturbed habitats (forest) and disturbed habitats (coffee plantations) as long as shade is available. It appears to prefer more humid conditions as compared to those preferred by *N. macrophallus*. In late March 2003, we found *N. dollfusianus* to be abundant at several localities, including Reserva Natural Los Tarrales (Fig. 7), in Departamento de Suchitepéquez, Guatemala. Commonly, individuals of this species can be observed sitting head-down in bushes, on fence posts and on the trunks of small trees, 20-80 cm above the ground. They are not wary and easy to catch by hand. Other anole species

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recorded sympatrically with *N. dollfusianus* are *N. petersii*, *N. serranoi*, and *N. sericeus* complex (Pacific versant).

Specimens examined: CHIMALTENANGO: Yepocapa: USNM 127974; Yepocapa, Finca La Palma, 1439 m: UMMZ 107111; Yepocapa, Finca Recreo, 1350 m: UMMZ 107581; Yepocapa, Finca Conchita, 1300 m: UMMZ 107582; Finca Payacal, near Pochuta: MCZ 46204; RETALHULEU: El Asintal, Abaj Takalik: UVG 2130; SAN MARCOS: El Amparo, 200 m: SMF 78439; Finca La Paz: UMMZ 98183 (1-3), 98184 (1-7), 98185 (1-6), 98186, 106956; Finca La Paz, 1-2 km NW main house, 1345-1510 m: UMMZ 107574 (1-3); Finca La Paz, 1 km SW main house, 1085-1135 m: UMMZ 107575 (1-2); Finca El Porvenir, Finca Colima, 887 m: UMMZ 107129; SW slope of Volcán Tajumulco, El Porvenir, Río Camarón: USAC 273-276; Finca La Paz, 1-2 km NE main house, ca. 1345 m [= 18 km N Coatepeque according to STUART 1949]: AMNH 80063, MCZ 56499; SOLOLA: Finca Santo Tomás, 1 km E main house, 400 m: UMMZ 107580; Finca Olas de Moka, 914 m: AMNH 38015; SUCHITEPEQUEZ: Volcán Atitlán: MNHN 2435, 1994.1361-63 (syntypes of *Anolis dollfusianus*); Volcán Zunil: CAS 67869, 67879, 67889, 67893, 67901, 67912-13, 67924, 67943, 67981; Finca Colima Pamaxán, San Antonio Suchitepéquez: AMNH 67705-06; Mazatenango: USNM 35674-75; Patulul, Volcán Atitlán: UVG 3275, 3281-3283, 1500 m; Patulul, Finca Pasamá, Reserva El Quetzal: UVG 3273, 3274, 3277-3280, 1470-1490 m; Finca El Cipres [= near Samayac, 610 m according to SLEVIN 1939]: MCZ 22960-61, 22963, 22968, UMMZ 64330 (1-2); Reserva Natural Los Tarrales, 14°31'57"N, 91°09'05"W, 950 m: SMF 82571-79; Reserva Natural Los Tarrales, 14°32'00"N, 91°10'00"W, 940 m: SMF 82580-81.

DEPARTMENT UNCLEAR: Finca San Diego: UF 33402, 33404, Finca Carolina: MCZ 22139.

Norops macrourus (WERNER, 1917)

1917 *Anolis macrourus* WERNER; Mitt. Zool. Mus. Hamburg 34: 31; type locality: San José, Guatemala. Neotype: SMF 79035 (designated by KÖHLER & KREUTZ 1999), from 18.2 km from Puerto San José on road to Escuintla (14°04.35'N, 90°46.59'W, 20 m elevation), Depto. Escuintla, Guatemala.

Distribution: Pacific versant of south-central Guatemala (Fig. 8) to central El Salvador.

Diagnosis: A medium-size species of *Norops* that can be distinguished from all other Guatemalan species of the genus except *N. capito*, *N. lemurinus* and *N. serranoi* by the combination of having (1) long hind legs (4th toe of adpressed hindlimb reaches at least to posterior border of eye; ratio tibia length / head length 0.98-1.13); (2) keeled ventral scales; (3) no enlarged postanal scales in males; (4) no tube-like axillary pocket; and (5) a divided prenasal scale. *Norops macrourus* differs from *N. lemurinus* and *N. serranoi* by having 19-25 subdigital lamellae of 4th toe (versus 25-33 in *N. lemurinus* and *N. serranoi*). *Norops macrourus* differs most notably from *N. capito* by its smaller size (SVL < 50 mm versus to 96 mm) and a relatively longer head (ratio tibia length / head length > 0.95 in *N. macrourus* versus < 0.90 in *N. capito*).

Description (Figs. 9, 10): Maximum SVL 48 mm in males, 47 mm in females; tail length / SVL ratio 1.65-2.02; tail slightly vertically oval to almost rounded in cross section, tail height / width ratio 0.7-1.1; longest toe of adpressed hind limb usually reaching to a point between posterior and anterior margin of eye; scales on snout



Fig. 8. Distribution
of / Verbreitung von
Norops macropthal-
lus in Guatemala.

strongly keeled; 6-8 postrostrals; 6-8 scales between nasals; one scale between circumnasal and rostral; usually two, rarely three, prenasal scales in a recurved series with the lowest prenasal scale contacting both the first supralabial and the rostral; scales in distinct frontal depression strongly keeled; supraorbital semicircles well developed, composed of keeled scales; 2-3 rows of scales separating supraorbital semicircles at narrowest point; 1-3 rows of scales separating supraorbital semicircles and interparietal at narrowest point; supraorbitals composed of 6-12 distinctly enlarged, strongly keeled scales; 1-2 enlarged supraorbitals in contact with supraorbital semicircles or all separated by a complete row of small scales; supraorbitals decreasing abruptly in size laterally; 4-5 rows of granular scales between enlarged supraoculars and superciliaries at level of mid-orbit; two elongated, overlapping superciliaries, followed by small granular scales posteriorly; interparietal scale well developed, markedly enlarged relative to adjacent scales; surrounded by scales of moderate size; canthal ridge distinct, composed of three large posterior and 5-6 small anterior scales; 8-11 scales present between second canthals; 9-14 scales present between posterior canthals; loreal region slightly concave, about 27-47 keeled loreal scales in a maximum of 6-8 horizontal rows; keeled subocular scales arranged in a single row; 6-8 supralabials to level below center of eye; suboculars separated from supralabials by one row of scales or these series in contact; mental completely divided medially, bordered posteriorly by 5-7 postmentals with the outer postmental scale on each side not greatly enlarged, their lengths less than the length of the mental scale; 6-9 infralabials to level below center of eye; sublabials undifferentiated; keeled granular scales present on chin and throat; lateral head scales anterior to the ear opening slightly larger than those posterior to the ear opening; ear opening vertically oval, ratio ear opening height / interparietal length 0.5-0.9; dorsum of body with small, flattened, keeled scales, 32-56 dorsal scales in one head length; about two median rows slightly enlarged, the rest of dorsals gradually grading into the granular and homogeneous laterals; ventrals at midbody strongly keeled, mucronate and subimbricate or imbricate; 22-37 ventral scales in one head length; dorsal, lateral and ventral caudal scales strongly keeled; dorsal medial caudal scales slightly enlarged, not forming a crest; no enlarged postanal scales in males; tube-like axillary pocket absent; limb scales keeled, imbricate; digital pads dilated, about twice as wide as non-dilated distal portion of toe; distal phalanx narrower than and raised from, dilated pad; 20-25 lamellae under phalanges II-IV of 4th toe; 6-8 scales under distal phalanx of 4th toe.

The completely everted hemipenis (SMF 79035) is a large bilobate organ with very elongate truncus and lobes (extremely Y-shaped); sulcus spermaticus bordered by well

The anoles (genus *Norops*) of Guatemala. I. The species of the Pacific versant

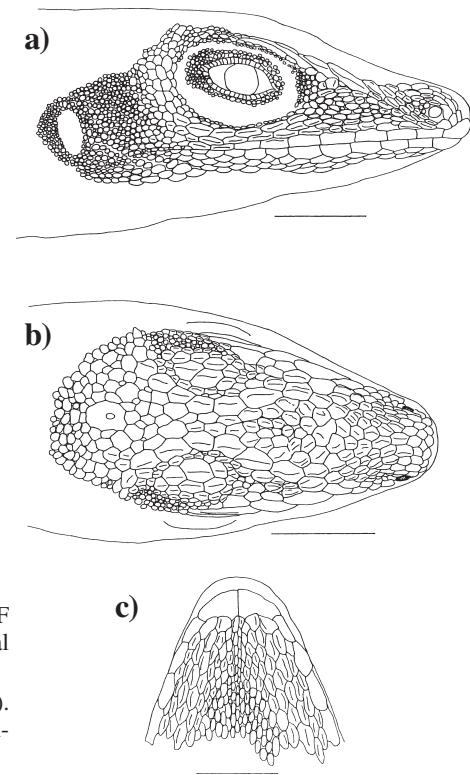


Fig. 9. Head of *Norops macrourus* (SMF 79035). a) lateral view; b) dorsal view; c) ventral view. Scale bars equal 1.0 mm.

Kopf von *Norops macrourus* (SMF 79035).
a) Lateralansicht; b) Dorsalansicht; c) Ventralansicht. Balken = 1,0 mm.



Fig. 10. Adult male of *Norops macrourus* (SMF 82605). SVL 48.5 mm.
Adultes Männchen von *Norops macrourus* (SMF 82605). KRL 48,5 mm.

developed sulcal lips, bifurcating at base of apex, the branches continuing to tips of lobes; surface of truncus and lobes with numerous small spines, except sulcal lips and extreme basal portion of truncus.

Dorsal surfaces of head, body, limbs and tail greyish to olive brown; ventral surfaces of head, body and tail dirty white or pale grey; tail only faintly banded. Dorsum of adult males usually with a dirty white or pale brown vertebral stripe. The colour pattern of adult female is much more variable than that of adult males. There are four main pattern types with many intermediate or combinations: (1) dorsum uniformly greyish to yellowish brown without a specific pattern; (2) dorsum with a broad cream-coloured dorsal stripe, narrowly edged with dark brown or black; (3) dorsum with a longitudinal series of diamond shaped mid-dorsal marks (usually the marks overlap, so that the posterior corner of one merges with the anterior part of the next); (4) dorsum with a series of transverse dark brown chevrons. Male dewlap flesh coloured with a large basal orange yellow blotch.

Natural History notes: In late March 2003, we found *Norops macrourus* to be abundant at several localities, including Fincas Tecolote (Fig. 11) and Medio Monte, in Departamento de Escuintla, Guatemala. We recorded this anole in disturbed dry forest and coffee plantations at elevations between near sea level and 1200 m. It appears to do well in areas where the original vegetation has been degraded as long as trees are providing shady places. Commonly, individuals of this species can be observed sitting head-down in bushes, on fence posts and on the trunks of small trees, 40–150 cm above the ground. They are not wary and easy to catch by hand. Other anole species recorded sympatrically with *N. macrourus* are *N. sericeus* complex (Pacific versant) and *N. serranoi*.

Specimens examined: ESCUINTLA: no specific data: MNHN 1980.1302; Finca El Zapote: UF 33401; 16.1 km W of Puerto San José, within 1.6 km of Pacific coast: USNM 165778; Finca Tecolote, Guanagazapa, 14°15'43"N, 90°38'03"W, 690 m: SMF 82602-07; Finca Tecolote, Guanagazapa, 14°15'55"N, 90°37'58"W, 710 m: SMF 82608-09; Finca Tecolote, Guanagazapa, 14°16'29"N, 90°37'50.5"W, 930 m: SMF 82610; Finca Medio Monte, 14°21'57"N, 90°44'12"W, 720 m: SMF 82611; Finca Medio Monte, 14°21'02"N, 90°44'07"W, 685 m: SMF 82612-13; El Rosario, Finca Vista Hermosa, ca. 6.4 km N Escuintla, 914 m: AMNH 94556; 18.2 km on road from Puerto San José to Escuintla, 14°04.35"N, 90°46.59'W, 20 m: SMF 79034, 79035; 5 km NW Puerto San Jose: UVG 511-514; Puerto San Jose, Base Militar: UVG 749; Masagua, ca 10 km S of Escuintla: UVG 2113; Carretera a Taxisco: UVG 3680; Carretera a Taxisco km: 82 UVG 553; JUTIAPA: Finca La Trinidad, near main house: UMMZ 107640, 107644; Finca La Trinidad, 4 km E main house: UMMZ 107641; Finca La Trinidad, 1-3 km W and NW main house: UMMZ 107642; Finca La Trinidad, 1 km E main house: UMMZ 107643; SANTA ROSA: Chiquihuitán (5 km N Avellana): AMNH 115663; Finca Los Positos: UVG 1543-1545, 1547; Finca La Gloria near main house: UMMZ 107634 (1-3); Finca La Gloria 1-3 km N and NW of main house, 945-1085 m: UMMZ 107635 (1-2); Finca El Progreso, ca. 1175-1200 m: UMMZ 120454-55.

Norops sericeus complex (Pacific versant)

1856 *Anolis sericeus* HALLOWELL, Proc. Acad. Nat. Sci. Philad. 1856: 227; type locality: Jalapa, Veracruz, Mexico.

1940 *Anolis ustus wellbornae* AHL; Sitz. Ges. Naturforsch. Freunde Berlin 1940: 246; type locality: El Salvador.

The anoles (genus *Norops*) of Guatemala. I. The species of the Pacific versant

Distribution: The various populations currently assigned to *Norops sericeus* are distributed from the Isthmus of Tehuantepec on the Pacific versant and Tamaulipas, Mexico, on the Caribbean versant along both versants to Costa Rica (but see comments).

Diagnosis: A medium-size species of *Norops* that can be distinguished from all other Guatemalan species of the genus by the combination of having (1) short hind legs (4th toe of adpressed hindlimb reaches to a point between shoulder and tympanum, rarely beyond tympanum; ratio tibia length / head length 0.78-1.03); (2) strongly keeled mucronate ventral scales; (3) no enlarged postanal scales in males; (4) no tube-like axillary pocket; and (5) a divided prenasal scale. *Norops sericeus* differs from *N. laeviventris* by having a single conspicuously large and elongate anterior superciliary present (versus 2-3 overlapping superciliaries in *N. laeviventris*); lateral body scales homogeneous (versus heterogeneous) laterals; males without enlarged postanal scales (versus enlarged postanal scales present in males). *Norops sericeus* differs from the other short-legged species of Guatemalan anoles (*N. cristifer*, *N. biporcatus*, *N. pentaprion*, *N. petersii*) most notably by its much smaller size (SVL < 50 mm in *N. sericeus* versus adults > 60 mm in *N. cristifer*, *N. biporcatus*, *N. pentaprion*, *N. petersii*) and by having a male dewlap that is orange with a blue or purple central blotch (dewlap colour not as above in *N. cristifer*, *N. biporcatus*, *N. pentaprion*, *N. petersii*).

Description (Figs. 12, 13): Maximum SVL 48 mm in males, 47 mm in females; tail length / SVL ratio 2.02-2.56; tail slightly vertically oval to almost rounded in cross section, tail height / width ratio 0.28-0.42; longest toe of adpressed hind limb usually reaching to a point between posterior and anterior margin of eye; scales on snout strongly keeled; 5-7 postrostrals; 6-8 scales between nasals; one scale between circumnasal and rostral; usually two, rarely three, prenasal scales in a recurved series with the lowest prenasal scale contacting both the first supralabial and the rostral; scales in distinct frontal depression strongly keeled; supraorbital semicircles well developed, composed of keeled scales; 2-3 rows of scales separating supraorbital semicircles at narrowest point; 1-3 rows of scales separating supraorbital semicircles and interparietal at narrowest point; supraorbitals composed of 6-12 distinctly enlarged, strongly keeled scales; 1-2 enlarged supraorbitals in contact with supraorbital semicircles or all separated by a complete row of small scales; supraorbitals decreasing abruptly in size laterally; 4-5 rows of granular scales between enlarged supraoculars and superciliaries at level of mid-orbit; two elongated, overlapping superciliaries, followed by small granular scales posteriorly; interparietal scale well developed, markedly enlarged relative to adjacent scales; surrounded by scales of moderate size; canthal ridge distinct, composed of three large posterior and 5-6 small anterior scales; 8-11 scales present between second canthals; 9-14 scales present between posterior canthals; loreal region slightly concave, about 27-47 keeled loreal scales in a maximum of 6-8 horizontal rows; keeled subocular scales arranged in a single row; 6-8 supralabials to level below center of eye; suboculars separated from supralabials by one row of scales or these series in contact; mental completely divided medially, bordered posteriorly by 5-7 postmentals with the outer postmental scale on each side not greatly enlarged, their lengths less than the length of the mental scale; 6-8 infralabials to level below center of eye; sublabials undifferentiated; keeled granular scales present on chin and throat; lateral head scales anterior to the ear opening slightly larger than those posterior to the ear opening; ear opening vertically oval, ratio ear opening height / interparietal length 0.4-0.7; dorsum of body with small, flattened, keeled scales, 32-56 dorsal scales in one head length; about two median rows

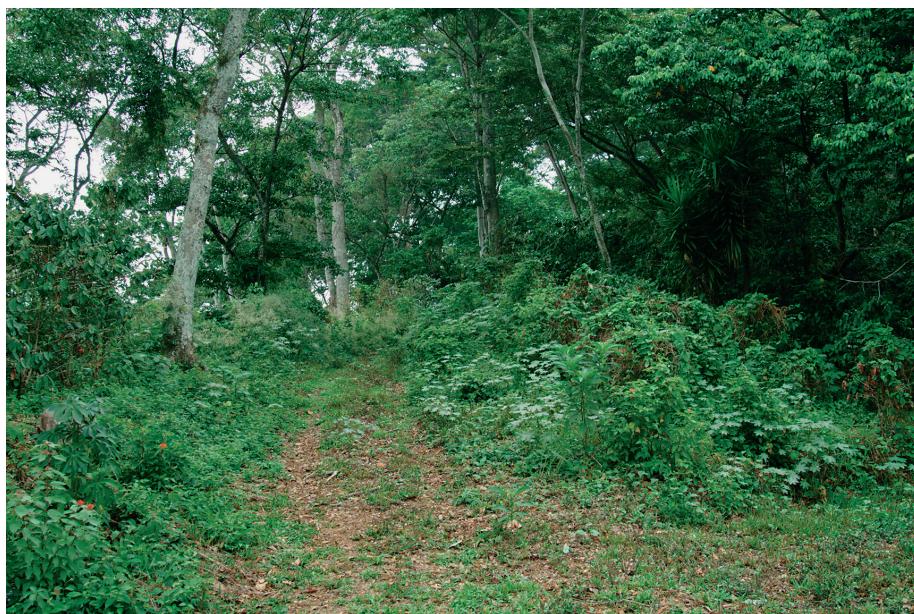


Fig. 11. Habitat of / Lebensraum von *Norops dollfusianus*, *N. serranoi*, and / und *Norops sericeus*-Komplex (Pazifikseite) at / bei Finca Tecolote, 790 m.

slightly enlarged, the rest of dorsals gradually grading into the granular and homogeneous laterals; ventrals at midbody strongly keeled, mucronate and subimbricate or imbricate; 22-37 ventral scales in one head length; dorsal, lateral and ventral caudal scales strongly keeled; dorsal medial caudal scales slightly enlarged, not forming a crest; no enlarged postanal scales in males; tube-like axillary pocket absent; limb scales keeled, imbricate; digital pads dilated, about twice as wide as non-dilated distal portion of toe; distal phalanx narrower than and raised from, dilated pad; 20-25 lamellae under phalanges II-IV of 4th toe; 6-8 scales under distal phalanx of 4th toe.

The completely everted hemipenis (SMF 82624) is a large bilobate organ; sulcus spermaticus bordered by well developed sulcal lips and bifurcating at base of apex; the branches of the sulcus spermaticus open into a broad concave area on each lobe; asulcate surface of apex and distal truncus strongly calyculate.

Dorsal surfaces of head, body, limbs, and tail greyish brown; often a dark postocular stripe from posterior corner of eye to above ear opening; usually with a dorsolateral pale brown, irregularly black edged, longitudinal stripe from ear opening to sacrum and with a lateral pale brown, irregularly black edged, longitudinal stripe from above shoulder to groin; limbs usually with some indistinct pale brown or bronze transverse or oblique stripes; ventral surfaces of head, body and tail dirty white, with longitudinal or oblique dark grey streaks in some individuals; tail only faintly banded. Dorsum of males usually without pattern. Most adult females have a broad middorsal cream-coloured stripe, separated from narrow paravertebral cream-coloured stripes by a narrow dark brown line. Male dewlap yellow or orange yellow with a central blue or purple blotch.

Natural History notes: *Norops sericeus* complex (Pacific versant) inhabits a wide range of habitats including dry forest, savanna, human settlements, and vegetation

The anoles (genus *Norops*) of Guatemala. I. The species of the Pacific versant

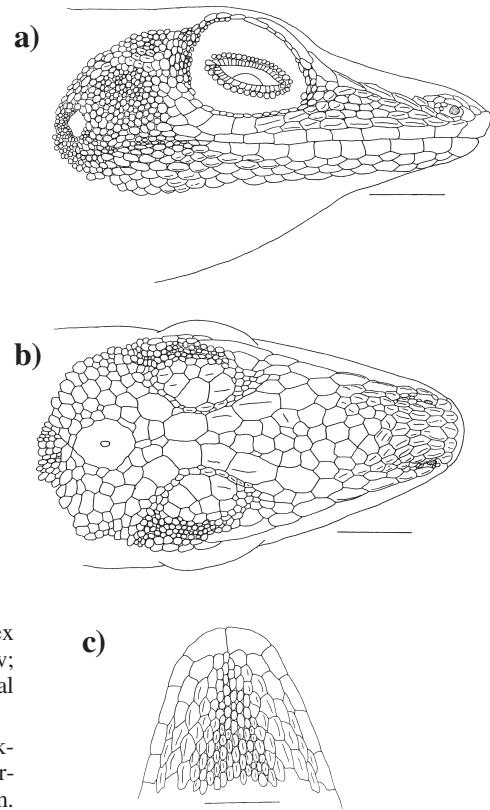


Fig. 12. Head of *Norops sericeus* complex (Pacific versant) (SMF 82667). a) lateral view; b) dorsal view; c) ventral view. Scale bars equal 1.0 mm.

Kopf von *Norops sericeus*-Komplex (Pazifikseite) (SMF 82667). a) Lateralansicht; b) Dor-
salansicht; c) Ventralansicht. Balken = 1,0 mm.



Fig. 13. Adult male of *Norops sericeus* complex (Pacific versant) (SMF 82664). SVL 45.5 mm.
Adultes Männchen von *Norops sericeus*-complex (Pazifikseite) (SMF 82664). KRL 45,5 mm.

along roads at elevations between near sea level and 1040 m. It appears to be especially abundant in disturbed areas and seems to tolerate aridness and heat better than any other anole on the Pacific versant. It is commonly observed sitting up-side-down 40–150 cm above the ground on the small (often horizontal) branches of bushes and small trees, and also on fence posts along trails and small roads. They are not wary and easy to catch by hand. Other anole species recorded sympatrically with *Norops sericeus* complex (Pacific versant) are *N. dollfusianus*, *N. macrourus* and *N. serranoi*.

Comments: We observed obvious differences in hemipenis morphology between populations of *sericeus*-like anoles from the Pacific versant of Central America versus those from the Caribbean versant. In adult males of *N. "sericeus"* from El Salvador and from the Pacific versant of Guatemala (Fig. 14), the hemipenis is a relatively large organ with well-developed lobes and a strongly calyculate surface. In specimens from the Atlantic versant of Mexico and Central America (Veracruz, Mexico, to southeastern Nicaragua) the hemipenis is unilobate without a calyculate surface and is much smaller relative to body size as compared to the hemipenis of specimens from El Salvador and from the Pacific versant of Guatemala. While these two hemipenial types show a parapatric geographical distribution pattern, variation in hemipenial morphology within these discrete types is negligible both within populations and in a geographical context. Because of the differences in hemipenial morphology we believe that we are dealing with two distinct species. This is partly supported by LEE (1980: 318) who studied geographic variation (morphometrics and scalation) of the *Norops sericeus* complex and stated that “a more persuasive case could be made for the recognition of Atlantic versus Pacific populations”. A detailed analysis of geographic variation (hemipenis morphology, osteology, morphometrics and scalation) of the *Norops sericeus* complex is in preparation (KÖHLER, VESELY, ACEVEDO, CEDEÑO, BAHENA in prep.). Until this review has been published we call the *N. "sericeus"* from the Pacific versant of Guatemala “*Norops sericeus* complex (Pacific versant)”

Specimens examined: CHIMALTENANGO: Finca Payacal, near Pochuta: MCZ 32496; ESCUINTLA: Finca El Zapote: UF 33506; Finca Tecolote, Guanagazapa, 14°16'10"N, 90°37'58"W, 790 m: SMF 82664; Finca Medio Monte, 14°21'02"N, 90°44'07"W, 685 m: SMF 82665; Río Coyolate: USNM 12598; 1 km N Puerto San José: SMF 79368-71; 18.2 km on road from Puerto San José to Escuintla, 14°04.35'N, 90°46.59'W, 20 m: SMF 79372-73; Masagua: UVG 2114; RETALHULEU: Champerico: CAS 68038-41; JUTIAPA: 7-8 km E Jutiapa along Río Amayita, 950 m: UMMZ 106950 (1-2); Finca La Trinidad, 1-4 km E main house: UMMZ 107619; Finca La Trinidad: UMMZ 107620; QUETZALTENANGO: El Palmar, Palajunoj, Finca Santa Anita: SMF 82622; RETALHULEU: Hacienda Casa Blanca, 1-2 km SW main house: UMMZ 107583; Hacienda Casa Blanca, 3 km W main house: UMMZ 107584; SAN MARCOS: ECA El Porvenir, camino de ingreso: USAC 277; SW slope of Volcán Tajumulco, El Porvenir, Río Camarón: USAC 278-79; Finca La Paz, 2 km NW La Reforma: UMMZ 98188-89; Finca El Porvenir, Finca Colima, 887 m: UMMZ 107128; El Amparo: SMF 78440; SANTA ROSA: Finca La Gloria, 1-2 km NW main house, 1040 m: UMMZ 107591; Finca La Gloria, 800-1010 m: MCZ 56498, UMMZ 107592; Finca La Gloria, 7 km SE main house, 750 m: UMMZ 107594; Las Lisas: UMMZ 107596; Finca Los Positos: UVG 1546; SUCHITEPEQUEZ: Reserva Natural Los Tarrales, 14°31'57"N, 91°09'05"W, 950 m: SMF 82670, SMF 82624-25; Finca San Julian, 14°28'01"N, 91°08'09"W, 480 m: SMF 82666, 82669; Volcán Zunil: CAS 67163; Finca El Cipres [= near Samayac, 610 m according to SLEVIN 1939]: MCZ 22965-67.

DEPARTMENT UNCLEAR: Finca San Diego: UF 33403, 33526-28.

Norops serranoi KÖHLER, 1999

1999 *Norops serranoi* KÖHLER, Salamandra 35(1): 39; type locality: forest in the vicinity of butterfly farm of Dr. FRANCISCO SERRANO ($13^{\circ}49,46'N$, $89^{\circ}59,98'W$), 225 m elevation, Ahuachapán, El Salvador.

Distribution: Pacific versant of northern Central America from Chiapas, Mexico, through southern Guatemala (Fig. 15) to El Salvador.

Diagnosis: A medium-size species of *Norops* that can be distinguished from all other Guatemalan species of the genus except *N. capito*, *N. lemurinus* and *N. macrophallus* by the combination of having (1) long hind legs (4th toe of adpressed hindlimb reaches at least to posterior border of eye; ratio tibia length / head length 0.92-1.12); (2) keeled ventral scales; (3) no enlarged postanal scales in males; (4) no tube-like axillary pocket; and (5) a divided prenasal scale. *Norops serranoi* differs from *N. macrophallus* by having mucronate ventral scales (versus those scales with rounded posterior margins). *Norops serranoi* differs most notably from *N. capito* by having a relatively longer head (ratio tibia length / head length > 0.90 in *N. serranoi* versus < 0.90 in *N. capito*). *Norops serranoi* differs from *N. lemurinus* by having a unilobate hemipenis (versus bilobate) and in dewlap colour (brick red with suffusion of black pigment centrally and with white scales in *N. serranoi* versus red with usually some black scales in *N. lemurinus*).

Description (Figs. 16, 17): Maximum SVL 80 mm in males, 70 mm in females; tail length / SVL ratio 1.71-2.26; tail slightly vertically oval to almost rounded in cross section, tail height / width ratio 0.7-0.9; longest toe of adpressed hind limb usually reaching to a point between posterior and anterior margin of eye; scales on snout strongly keeled; 6-9 postrostrals; 6-8 scales between nasals; one scale between circumnasal and rostral; usually three prenasal scales in a recurved series with the lowest prenasal scale contacting both the first supralabial and the rostral; scales in distinct frontal depression rugose; supraorbital semicircles well developed, composed of keeled scales; 1-2 rows of scales separating supraorbital semicircles at narrowest point; 2-5 rows of scales separating supraorbital semicircles and interparietal at narrowest point; supraorbitals composed of 10-18 slightly to distinctly enlarged, strongly keeled scales; 1-2 enlarged supraorbitals in contact with supraorbital semicircles or all separated by a complete row of small scales; supraorbitals decreasing abruptly in size laterally; 4-6 rows of granular scales between enlarged supraoculars and superciliaries at level of mid-orbit; two elongated, overlapping superciliaries, followed by small granular scales posteriorly; interparietal scale well developed, markedly enlarged relative to adjacent scales; surrounded by scales of moderate size; canthal ridge distinct, composed of three large posterior and 3-4 small anterior scales; 6-9 scales present between second canthals; 8-13 scales present between posterior canthals; loreal region slightly concave, about 37-55 keeled loreal scales in a maximum of 6-8 horizontal rows; keeled subocular scales arranged in a single row; 6-9 supralabials to level below center of eye; suboculars usually separated from supralabials by one row of scales (these series narrowly in contact in some individuals); mental completely divided medially, bordered posteriorly by 6-8 postmentals with the outer postmental scale on each side not greatly enlarged, their lengths less than the length of the mental scale; 6-8 infralabials to level below center of eye; sublabials undifferentiated; keeled granular scales present on chin and throat; lateral



Fig. 14. Distribution of / Verbreitung von *Norops sericeus* complex (Pacific versant) on the Pacific versant of Guatemala.



Fig. 15. Distribution of / Verbreitung von *Norops serranoi* in Guatemala.

head scales anterior to the ear opening slightly larger than those posterior to the ear opening; ear opening vertically oval, ratio ear opening height / interparietal length 0.5-0.9; dorsum of body with small, flattened, keeled scales, 32-52 dorsal scales in one head length; about two median rows slightly enlarged, the rest of dorsals gradually grading into the granular and homogeneous laterals; ventrals at midbody strongly keeled, mucronate and imbricate or imbricate; 24-38 ventral scales in one head length; dorsal, lateral, and ventral caudal scales strongly keeled; dorsal medial caudal scales slightly enlarged, not forming a crest; no enlarged postanal scales in males; tube-like axillary pocket absent; limb scales keeled, imbricate; digital pads dilated, about twice as wide as non-dilated distal portion of toe; distal phalanx narrower than and raised from, dilated pad; 25-33 lamellae under phalanges II-IV of 4th toe; 7-9 scales under distal phalanx of 4th toe.

The completely everted hemipenis (SMF 82568) is a large unilobate organ; sulcus spermaticus bordered by well developed sulcal lips, opening at base of apex into a broad slightly concave area; asulcate surface of apex and distal truncus strongly calyculate, distal part of truncus with numerous small folds.

Dorsal surfaces of head, body, limbs and tail greyish to olive brown; a dark brown interorbital bar, dark brown lines radiating outward from the orbit, and a dark brown nuchal lyriform mark usually present; usually with a dorsolateral pale brown, irregularly black edged, longitudinal stripe from ear opening to sacrum and with a lateral pale brown, irregularly black edged, longitudinal stripe from above shoulder to groin; ventral surfaces of head, body and tail dirty white or pale grey; tail only faintly banded. The colour pattern of adult males and females is very variable without an obvious

The anoles (genus *Norops*) of Guatemala. I. The species of the Pacific versant

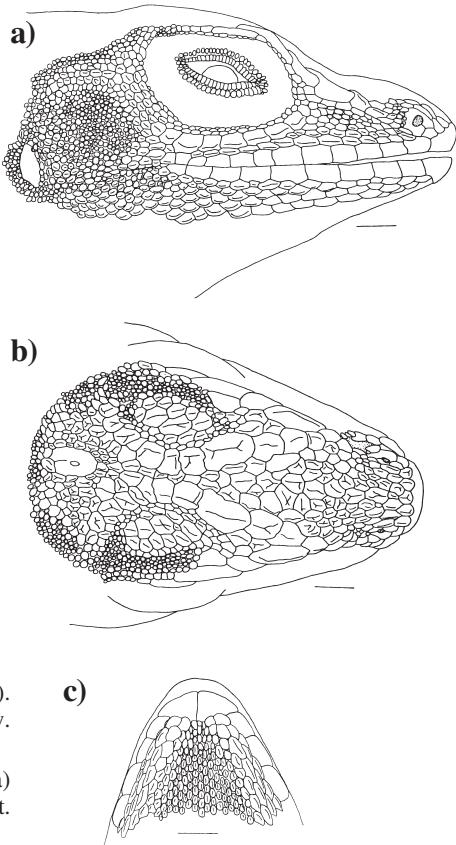


Fig. 16. Head of *Norops serranoi* (SMF 82564).
a) lateral view; b) dorsal view; c) ventral view.
Scale bars equal 1.0 mm.

Kopf von *Norops serranoi* (SMF 82564). a)
Lateralansicht; b) Dorsalansicht; c) Ventralansicht.
Balken = 1,0 mm.



Fig. 17. Adult male of *Norops serranoi* (SMF 82564). SVL 74.0 mm.
Adultes Männchen von *Norops serranoi* (SMF 82564). KRL 74,0 mm.

		<i>N. cristifer</i>	<i>N. dolffusianus</i>	<i>N. macrourus</i>	<i>N. serranoi</i>	<i>N. wellbornae</i>
maximum SVL	males	88 mm	39 mm	48 mm	80 mm	47 mm
	females	70 mm	42 mm	47 mm	70 mm	47 mm
tail length / SVL	males	1.36-1.38	(1.37±0.51)	1.76-2.00	(1.91±0.08)	1.65-2.02
	females	1.31	1.60-1.89	(1.78±0.10)	1.71-1.90	(1.83±0.09)
tail diameter	males	1.13-1.51	(1.32±0.19)	1.13-1.27	(1.21±0.05)	0.90-1.35
vertical/horizontal	males	0.86-1.29	(1.08±0.22)	1.06-1.20	(1.12±0.05)	1.00-1.11
axilla-groin	males	0.40-0.46	(0.43±0.02)	0.34-0.46	(0.39±0.04)	0.39-0.47
distance / SVL	males	0.44-0.46	(0.45±0.01)	0.35-0.48	(0.42±0.04)	0.40-0.51
HL / SVL	males	0.25-0.26	(0.258±0)	0.26-0.28	(0.269±0.01)	0.25-0.30
	females	0.25-0.26	(0.255±0)	0.26-0.30	(0.275±0.01)	0.25-0.27
HL / HW	males	1.56-1.75	(0.632±0.08)	1.49-1.60	(0.563±0.03)	1.43-1.72
	females	1.60-1.79	(1.693±0.10)	1.50-1.61	(1.557±0.04)	1.49-1.65
snout length/ SVL	males	0.12-0.13	(0.128±0.01)	0.11-0.13	(0.116±0.01)	0.10-0.13
	females	0.11-0.12	(0.119±0)	0.12-0.14	(0.123±0.01)	0.12-0.14
snout length/ HL	males	0.47-0.53	(0.497±0.03)	0.40-0.47	(0.431±0.10)	0.40-0.47
	females	0.45-0.48	(0.466±0.01)	0.42-0.48	(0.447±0.02)	0.42-0.48
shank length/SVL	males	0.18-0.20	(0.190±0)	0.24-0.31	(0.267±0.02)	0.26-0.30
	females	0.17-0.19	(0.180±0.01)	0.24-0.29	(0.266±0.02)	0.25-0.28
shank length/HL	males	0.70-0.76	(0.737±0.02)	0.89-1.10	(0.990±0.05)	0.98-1.13
	females	0.68-0.73	(0.705±0.02)	0.91-1.06	(0.967±0.05)	1.00-1.05
subdigital lamellae of 4th toe	males	30-37	(33.6±2.42)	19-25	(22.9±1.31)	20-25
number of scales between SS	1-2	(1.2±0.4)	0-2	(0.8±0.51)	2-3	(2.1±0.30)
number of scales between IP and SS	2-4	(2.80±0.75)	1-4	(2.47±0.50)	1-4	(2.69±0.56)
number of scales between SO and SPL		0	0	0-1	(0.94±0.23)	0-1
number of SPL to level below center of eye		9-11	(9.6±0.80)	5-7	(6.1±0.70)	6-8
number of INL to level below center of eye		8-10	(9.3±0.83)	5-7	(6.1±0.65)	6-9
total number of loreals		25-43	(32.4±7.55)	24-44	(32.7±5.42)	27-47
and SS						
number of scales between SO and SPL						
number of SPL to level below center of eye						
number of INL to level below center of eye						
total number of loreals						

number of horizontal loreal scale rows	4-6 (5.0±0.63)	5-6 (5.8±0.43)	5-6 (7.4±0.78)	6-8 (6.9±0.74)	6-8 (4.9±0.42)
number of postrostrals	6-8 (7.0±0.71)	4-6 (5.0±0.45)	6-8 (7.2±0.50)	5-7 (5.4±0.60)	6-9 (7.4±0.68)
number of postmentals	4-6 (5.5±0.87)	6-8 (6.3±0.54)	5-7 (6.1±0.57)	6-8 (6.4±0.68)	4-7 (5.6±0.76)
number of scales between nasals	6-7 (6.5±0.50)	6-8 (6.7±0.57)	6-8 (7.0±0.67)	6-8 (7.0±0.67)	6-8 (6.88±0.58)
number of scales between 2nd canthals	7-8 (7.6±0.49)	7-8 (7.5±0.50)	8-11 (9.1±1.03)	6-9 (8.1±1.00)	6-10 (7.6±1.09)
number of scales between posterior canthals	9-10 (9.8±0.40)	9-10 (9.8±0.43)	9-14 (12.2±1.16)	8-13 (9.8±1.30)	7-11 (9.2±1.29)
number of medial dorsal scales in one head length	34-48 (40.0±4.73)	36-48 (42.2±9.61)	32-56 (39.4±6.15)	32-52 (43.3±5.79)	28-40 (31.9±3.25)
Number of ventral scales in one head length	40-56 (47.6±4.73)	34-50 (40.7±5.66)	22-37 (31.3±3.87)	24-38 (27.9±3.54)	22-30 (25.1±2.39)

Tab. 1. Selected measurements, proportions and scale characters for five species of *Norops* known to occur on the Pacific versant of Guatemala below 1500 m elevation. Range is followed by mean value and one standard deviation in parentheses. Abbreviations: SVL = snout-vent length; HL = head length; HW = head width; SS = supraorbital semicircles; IP = interparietal plate; SO = subocular scales; SPL = supralabial scales, INL = infralabials. Data from ten males and ten females of each species except for *Norops cristifer* (3 males and 2 females).

Vergleich von morphometrischen und pholidotischen Merkmalen bei den fünf *Norops*-Arten, die von der Pazifikseite Guatemalas unterhalb von 1500 m üNN nachgewiesen sind. Angegeben sind Variationsbreite, gefolgt von Mittelwert und Standardabweichung in Klammern. Abkürzungen: SVL = Kopfrumpflänge; HL = Kopflänge; HW = Kopfbreite; SS = supraorbitalale Halbkreise; IP = Interparietalschild; SO = Suboculare; SPL = Supralabiale, INL = Sublabiale. Daten von jeweils 10 Männchen und 10 Weibchen pro Art außer bei *Norops cristifer* (3 Männchen und 2 Weibchen).

sexual correlation of pattern types. There are four main pattern types with many intermediate or combinations: (1) dorsum uniformly greyish to yellowish brown without a specific pattern; (2) dorsum with a longitudinal series of broad dark brown dorsal saddles; (3) dorsum with a series of longitudinal dark brown elongate vertebral marks. Male dewlap brick red with suffusion of black pigment centrally and with white scales.

Natural History notes: *Norops serranoi* prefers shady situations on large trees in undisturbed dry forests (in shady situations) and is also found in high densities close to human settlements at elevations between near sea level and 1040 m. It is commonly observed sitting up-side-down 40-150 cm above the ground on trees, *Yucca* plants, and fence posts along small roads. *Norops serranoi* is also found on the walls and on the wooden roofs of old abandoned houses. They are not wary and easy to catch by hand. Other anole species recorded sympatrically with *N. serranoi* are *N. dolffusianus*, *N. macrophallus* and *N. sericeus* complex (Pacific versant). This species is believed to be venomous by some local people, mostly because of its large red dewlap.

Specimens examined: ESCUINTLA: Finca Tecolote, Guanagazapa, 14°15'43"N, 90°38'03"W, 690 m: SMF 82564; Finca Tecolote, Guanagazapa, 14°15'55"N, 90°37'58"W, 710 m: SMF 82565-66; 1 km N Puerto San José: SMF 81130-32; Río Coyolate: USNM 12595-97; Carretera a Puerto Quetzal: UVG 2819; RETALHULEU: near Champerico: SMF 43742-43; Hacienda Casa Blanca, 1-3 km SW main house: UMMZ 107564 (1-5), 107565 (1-5), 107566 (1-3), 107567 (1-2), 1075685 (1-3); SAN MARCOS: El Amparo: SMF 77719-20; SANTA ROSA: Finca La Gloria, 950 m: UMMZ 107569; Finca La Gloria, 1 km NE main house, 1040 m: UMMZ 107570; Finca La Gloria, 1 km S main house, 830 m: UMMZ 107571; SUCHITEPEQUEZ: Finca San Julian, 14°27'33"N, 91°08'17"W, 460 m: SMF 82567; Reserva Natural Los Tarrales, 14°31'57"N, 91°09'05"W, 950 m: SMF 82568-70; Volcán Zunil: CAS 67151-52, 67159, 67167; Mazatenango, Salache Coffee Plantation: CAS 67118; Mazatenango: USNM 35673.

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Die Anolis (Gattung *Norops*) von Guatemala. I. Die Arten der Pazifikseite unterhalb 1500 m üNN

Basierend vor allem auf Unterschieden in der Hemipenismorphologie wird *Norops sericeus* als Artenkomplex aufgefasst. Erwachsene Männchen von *N. „sericeus“* aus El Salvador und von der

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Pazifikseite Guatemalas haben einen relativ großen Hemipenis mit zwei gut entwickelten Loben und einem ausgeprägten Wabenmuster auf der Oberfläche. Exemplare von der Atlantikseite Mexikos und Mittelamerikas (Veracruz, Mexico, bis ins südöstliche Nicaragua) hingegen haben einen relativ kleinen einlobigen Hemipenis ohne Wabenmuster auf der Oberfläche. Aufgrund dieser ausgeprägten Hemipenis-Unterschiede gehen wir davon aus, dass es sich hierbei um zwei eigenständige Arten handelt. Wir sehen aber zum jetzigen Zeitpunkt von nomenklatorischen Änderungen ab und bezeichnen die Populationen der Pazifikseite vorläufig als „*Norops sericeus*-Komplex (Pazifikseite)“, bis die Taxonomie und Nomenklatur dieses Komplexes befriedigend geklärt ist.

Norops cristifer wird als eigenständige Art aufgefasst und nicht als Unterart von *N. pentaprion*, wie von früheren Autoren vorgeschlagen. Begründet wird diese Aufwertung mit konstant unterschiedlichen Beschuppungsmerkmalen (Männchen von *N. cristifer* haben einen ausgeprägten Rückenkamm, gebildet durch eine Reihe vergrößerter Stachelschuppen; Männchen von *N. pentaprion* haben keinen Rückenkamm, sondern nur eine Doppelreihe leicht vergrößerter, nicht-stachliger Schuppen). Auch unterscheiden sich die beiden Taxa in der Adultgröße (*N. cristifer* bis 88 mm; *N. pentaprion* bis 79 mm). *Norops cristifer* kommt auf der Pazifikseite des östlichen Chiapas, Mexiko, und westlichen Guatemalas vor, während *N. pentaprion* in Mexiko und im nördlichen Mittelamerika auf die Karibikseite beschränkt ist.

Sieben Arten der Gattung *Norops* sind von der Pazifikseite Guatemalas unterhalb 1500 m üNN bekannt (*N. cristifer*, *N. dollfusianus*, *N. laeviventris*, *N. macrophallus*, *N. petersii*, „*Norops sericeus*-Komplex (Pazifikseite)“ und *N. serranoi*); für diese Arten wird ein Bestimmungsschlüssel vorgestellt. Für fünf der genannten Arten (außer *N. laeviventris* und *N. petersii*, die in einer der folgenden Teile dieser Publikationsreihe behandelt werden sollen) werden die individuelle Variation (Körperproportionen, Beschuppung, Hemipenismorphologie und Färbung) sowie geografische Verbreitung zusammenfassend dargestellt und mit Abbildungen illustriert. Es werden Notizen zur Lebensweise mitgeteilt. *Norops cristifer* ist in Guatemala nur von wenigen Exemplaren aus dem Südwesten des Landes bekannt. Die Art unterscheidet sich von allen anderen *Norops*-Arten der Pazifikseite durch sehr kurze Hinterbeine und einen meist deutlich ausgebildeten Rückenkamm. *Norops dollfusianus* bewohnt die Abhänge der Pazifikseite des westlichen Guatemalas (meist 800-1510 m üNN, ausnahmsweise auch in tieferen Lagen) und unterscheidet sich von allen anderen *Norops*-Arten der Pazifikseite durch das Vorhandensein einer ungeteilten Pränasalschuppe und einer gelben Kehlfahne bei den adulten Männchen. *Norops macrophallus* bewohnt das Tiefland und die Abhänge der Pazifikseite des südöstlichen Guatemalas (nahe Meeresspiegel bis 1200 m üNN) und unterscheidet sich von allen anderen *Norops*-Arten der Pazifikseite durch folgende Merkmalskombination: Langbeinig, Pränasalschuppe geteilt, 19-25 Lamellen unter der 4. Zehe und eine fleischfarbene Kehlfahne mit orangefarbem Fleck an der Basis bei den adulten Männchen. *Norops serranoi* bewohnt das Tiefland und die Abhänge der Pazifikseite Guatemalas (nahe Meeresspiegel bis 1040 m üNN) und unterscheidet sich von allen anderen *Norops*-Arten der Pazifikseite durch folgende Merkmalskombination: Langbeinig, Pränasalschuppe geteilt, 25-33 Lamellen unter der 4. Zehe und eine rote Kehlfahne bei den adulten Männchen. *Norops sericeus*-Komplex (Pazifikseite) ist auf der Pazifikseite Guatemalas weit verbreitet (nahe Meeresspiegel bis 1040 m üNN) und unterscheidet sich von allen anderen *Norops*-Arten der Pazifikseite durch folgende Merkmalskombination: Kurzbeinig, eine auffallend lange Superciliarschuppe vorhanden, äußere Ohröffnung sehr klein, ohne vergrößerte Postanalschuppen; Kehlfahne der adulten Männchen gelb oder gelborange mit zentralem blauen Fleck. An einem Standort kommen typischerweise mehrere (bis zu vier) *Norops*-Arten sympatrisch vor.

Schlagwörter: Squamata: Iguanidae: *Norops*; Pazifikseite Guatemala.

Resumen

Siete especies de *Norops* ocurren a lo largo de la vertiente Pacífica de Guatemala por debajo de los 1500 m de elevación: *N. cristifer*, *N. dollfusianus*, *N. laeviventris*, *N. macrophallus*, *N. petersii*, *N. sericeus* complejo y *N. serranoi*; una clave para estas especies es proporcionada. Listados de

variaciación individual (proporciones del cuerpo, escamacion, morfología de los hemipenes y patrones de coloración), distribución geográfica, y gráficas también son proporcionadas para cinco de estas especies (*N. laeviventris* and *N. petersii* serán incluidos en una segunda parte de esta serie de artículos): *Norops cristifer* se conoce solamente de unos cuantos ejemplares del sudoeste de Guatemala. Esta especie difiere de todas las demás especies del género *Norops* del Pacífico guatemalteco en poseer miembros traseros muy cortos y usualmente una cresta media-dorsal usualmente bien desarrollada. *Norops dollfusianus* habita la bocanilla de la vertiente Pacífica del suroeste de Guatemala (mayormente entre 800 y 1510 m de elevación; en ocasiones muy excepcionales a elevaciones menores) y difiere de todas las demás especies de *Norops* en el Pacífico en que tiene una escama prenasal no dividida y una papada gular amarilla en los machos adultos. *Norops macrophallus* habita la costa del Pacífico del sureste guatemalteco (desde cerca del nivel del mar hasta los 1200 m de elevación) y difiere del resto de especies en la siguiente combinación de caracteres: Miembros traseros largos una escama prenasal dividida, de 19 a 25 laminillas subdigitales del 4to. dedo de la extremidad trasera, y una papada gular de color morado pálido con una mancha amarillo-naranja en su base presente en los machos adultos. *Norops serranoi* está ampliamente distribuido a lo largo de la vertiente Pacífica de Guatemala (cerca del nivel del mar hasta los 1400 m de elevación) y se distingue de las otras especies de *Norops* del Pacífico guatemalteco por la siguiente combinación de caracteres: Extremidades posteriores largas, una escama prenasal dividida, de 25 a 33 laminillas subdigitales en el 4to. dedo de la pata trasera, papada gular de los machos (en vida) de color rojo ladrillo con cierta pigmentación negra en la parte central y la presencia también de escamas blancas. *Norops sericeus* complejo también tiene una distribución amplia en el Pacífico de Guatemala (cerca del nivel del mar a los 1040 m de elevación) y se diferencia de las otras especies de *Norops* del Pacífico guatemalteco por la siguiente combinación de caracteres: Extremidades posteriores cortas, una sola grande, alargada y conspicua escama superciliar anterior presente; machos sin escamas postnasales agrandadas; la papada gular de los machos de color amarillo-naranja con una gran mancha azul o purpura en el centro de la misma. Usualmente varias (hasta cuatro) de estas especies ocurren en el mismo lugar.

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