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Notes on a Colubrid Snake, *Tantilla vermiformis*, from Central America

ROBERT WAYNE VAN DEVENDER[1] AND CHARLES J. COLE[2]

ABSTRACT

Tantilla vermiformis has been known from only seven specimens, all from Nicaragua, only one of which has precise locality data. We report here the discovery of 25 specimens in Costa Rica and present new information on the biology of the species: distribution, ecology, reproduction, external morphology, osteology, hemipenes, chromosomes and relationships. We designate USNM 32338 as the lectotype.

INTRODUCTION

The genus *Tantilla* contains about 47 species distributed between the central United States and northern Argentina (Peters and Orejas-Miranda, 1970). There is no comprehensive review of the genus, and relationships among species and species groups are poorly known. Study of these snakes is difficult for several reasons: (1) Many species are known from few individuals, so variation in scutellation, coloration and other classical taxonomic characters is poorly known; (2) they are small, secretive, fossorial animals with scutellation simplified by scale fusion; (3) most investigators have not used such potentially important characters as are available in hemipenis morphology, osteology and karyotypes.

Since 1972, 25 specimens of *Tantilla vermiformis* (Hallowell, "1860" [1861?]) have been found on the Pacific versant near Los Angeles de Tilarán, Guanacaste Province, Costa Rica. This species has been known previously from a total of only seven specimens, all from Nicaragua, and only one of these previous specimens had precise locality data (Wilson and Villa, 1973). Because little is known about this species and because studies of variation in local populations provide baselines for comparative work in systematics, we report the Costa Rican series in detail here and comment on various aspects of its biology: distribution, ecology, reproduction, external morphology, osteology, hemipenes, chromosomes, and relationships.

Hallowell ("1860" [1861?]) described *Lioninia vermiformis* and stated that there were three specimens from "Nicaragua." Cope (1861) examined the syntypes and placed the species in the genus *Tantilla*. Later, Cope (1875) mentioned that there were four syntypes of *T. vermiformis*, when he described *Tantilla canula* on the basis of an additional specimen that previously

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he (Cope, 1866) had referred to *T. vermiformis*. The four syntypes of *T. vermiformis* are now USNM 32338-32341. They were recatalogued from USNM 5792 in the year 1903, with the notation "Ret. from Cope's estate." The confusion regarding the syntypes and our examination of a large number of specimens, including re-examination of the type-series by one of us (R.W.V.) make it desirable to designate a lectotype here.

There is no way to recognize which of the four specimens of USNM 32338-32341 was not in the original type-series of three specimens mentioned by Hallowell ("1860" [1861?]), or whether in fact that statement was an error and actually there always were four syntypes. The original catalogue at the National Museum of Natural History (USNM) states that all four specimens were originally catalogued there together in 1861 (Alan H. Savitzky, personal commun.). Three of the four syntypes are significantly incomplete. The heads and tails of USNM 32339 and 32341 are missing, and USNM 32340 is separated into three parts with some skin missing from between them. USNM 32338 is the only specimen that is essentially intact. It agrees with Hallowell's ("1860" [1861?]) description of coloration and head scutellation, although it does not have 122 ventrals and 26 subcaudals as mentioned in the original description; USNM 32338 has 119 ventrals and 21+ subcaudals (tail nearly, but not, complete). None of the other syntypes matches the original description more closely than this specimen,[1] however, so we designate USNM 32338 as the lectotype.

ACKNOWLEDGMENTS

We thank Dr. Norman J. Scott, Dr. Robert Wilkinson, Mrs. Amy Van Devender and Dr. James DeWeese for assistance in collecting and transporting specimens. Permission to collect and export these animals was provided by the Ministerio de Agricultura y Ganaderia, Sylvestre y Pescado, through the courtesy of Señor Herbert Nanne. Appreciation of permission to examine specimens in their care is extended to Dr. Arnold G. Kluge and Dr. Ronald A. Nussbaum (UMMZ), Dr. Tom Collins and Dr. William E. Duellman (KU), Dr. Jay M. Savage (CRE), Dr. John W. Wright (LACM) and Dr. George R. Zug and Dr. W. Ronald Heyer (USNM). In addition, we are grateful to Dr. Thomas Moore, who identified the insect parts, Mr. P. Dayanandan and Mr. V. Baldwin for assistance in preparing the scanning electron micrographs, Mr. Juan Carlos Barberis, who rendered the illustrations of a hemipenis, Ms. Carol R. Townsend, who made the chromosome preparations, and to Dr. Roy W. McDiarmid, Dr. Ronald A. Nussbaum, Mr. Paul E. Feaver and Dr. Douglas Ruby, who read an early draft of the manuscript.

METHODS

The 25 *T. vermiformis* were collected in Guanacaste Province, Costa Rica between 1972 and 1975. Several living ones were sent directly to the American Museum of Natural History, New York, for study of chromosomes and hemipenes. The remaining specimens were preserved immediately for analysis of diet and scutellation. Trunk vertebrae from one specimen were prepared by water maceration. Twenty-five midbody vertebrae were measured as described by Auffenberg (1963). Other osteological preparations were made from five additional specimens. Variation in all characters was determined and compared with that of the seven Nicaraguan specimens. All values are expressed as: Range (mean ± standard error [SE], N = sample size). The SE is omitted if sample size is fewer than 10. Statistical comparisons were based on *t*-tests, using the 95 percent confidence level.

We used the Dowling (1951) method in counting ventral scales. Subcaudals were counted on one side, beginning with the first scale in contact with its opposite number. The terminal spine was not counted. Condition of the anal plate was noted on all specimens. Head scales counted were supralabials, infralabials, preoculars, postoculars, temporals, and genials. Contact between postnasal and preocular was recorded as was contact between mental and anterior genials. An ocular micrometer was used to determine length and

[1] In the original description, Hallowell ("1860" [1861?], p. 484) stated "a single preanal; . . .," which is highly unusual in *Tantilla*. This statement is an error, however, as all four syntypes have a divided anal plate.

width of dorsal head scales, eye size, snout length and distance between tip of snout and anterior edge of naris.

Body length (snout-vent), tail length and the ratio of tail length to total length were obtained for all animals with complete tails. Presence or absence of the left oviduct (Clark, 1970) was checked in four adult females. Reproductive state and diet were determined by dissection. Coloration characters were noted for all specimens. Maxillary teeth were counted in 18 snakes, palatine and pterygoid teeth in two, and mandibular teeth in two. Skull characters were examined on three dry preparations (UMMZ nos. 132192, 135260, 139892) and in one cleared and stained specimen (UMMZ no. 132189-OP 6384).

We examined hemipenes using the methods and terminology of Dowling and Savage (1960) and of Myers (1974). Everted organs were studied either without special preparation or after injection of colored liquid latex (Dowling and Savage, 1960).

Chromosomes of bone marrow (from crushed vertebrae, as suggested by Dr. Laurence M. Hardy) and testicular cells were prepared for examination by means of the colchicine, hypotonic citrate, flame-dried procedure (Patton, 1967), slightly modified for reptiles (Cole and Leavens, "1971" [1972]). We employ the chromosome terminology used by Cole (1970).

SPECIMENS EXAMINED

Specimens in the following herpetological collections were examined: the American Museum of Natural History (AMNH), Natural History Museum of Los Angeles County (LACM), National Museum of Natural History, Smithsonian Institution (USNM), University of Kansas Museum of Natural History (KU), University of Michigan Museum of Zoology (UMMZ) and the University of Southern California (CRE). Specimens were from the following localities: NICARAGUA, USNM 32338-32341 (syntypes) and USNM 75711, 75712. NICARAGUA: *Departamento León*: Laguna Monte Galán, 80 m. elev., KU 159587 (= Jaime Villa no. 7178). COSTA RICA: *Guanacaste Province*: 0.6 km. E Los Angeles de Tilarán, 480 m. elev., UMMZ 132187, 132188; 1.0 km. E Los Angeles de Tilarán, 500 m. elev., LACM 122002, 122003, UMMZ 135259(6), 135260, 131399, 132191, 132192, 133892(2), 138224 and AMNH 111325-111327; 1.2 km. E Los Angeles de Tilarán, 510 m. elev., CRE 3730; 2 km. E Los Angeles de Tilarán, 520 m. elev., AMNH 111323, 111324 and UMMZ 132189; Finca La Pacifica, 5.5 km. NW Cañas, 50 m. elev., CRE 2217.

RESULTS

ECOLOGY

Of these 25 specimens all but one was collected in or under rotting logs in pastures between 0.6 and 2.0 km. (airline) east of Los Angeles de Tilarán, Guanacaste Province, Costa Rica, elevation 480 to 520 m. (fig. 1A); most of the snakes were 3 to 5 cm. below the surface in moist, sandy soil. The exceptional specimen (CRE 2217, fig. 1B) was under a small stone in tropical deciduous forest at Finca La Pacifica, 5.5 km. (airline) northwest of Cañas, Guanacaste Province, elevation 50 m.; it was on the surface of dry, packed soil near the entrance to a small burrow.

Tantilla vermiformis is not evident at these sites throughout the year. Despite considerable effort, only two individuals (CRE 2217 and UMMZ 138224) were found during the dry season (mid-November to mid-May). Monthly totals from May to October, respectively, were: 2, 4, 0, 9, 2, 8. Presumably the snakes are deeper in the soil during drier periods. The sex ratio in the total sample is near unity (14 males, 11 females), and representatives of both sexes are present in all series.

The only small juveniles (N=3) were taken on August 19, 1972. Females were not ovigerous then, but one had begun deposition of yolk in a single follicle. A female collected on June 23, 1973 contained a single enlarged (5 mm.) egg. These observations suggest that reproduction takes place in the wet season. Since no other juvenile size classes are evident, maturity is probably reached in one year. The left oviduct is vestigial (Clark, 1970) in the four adults examined for this character.

Stomach contents of 10 animals were examined, and the following six items (five insects,

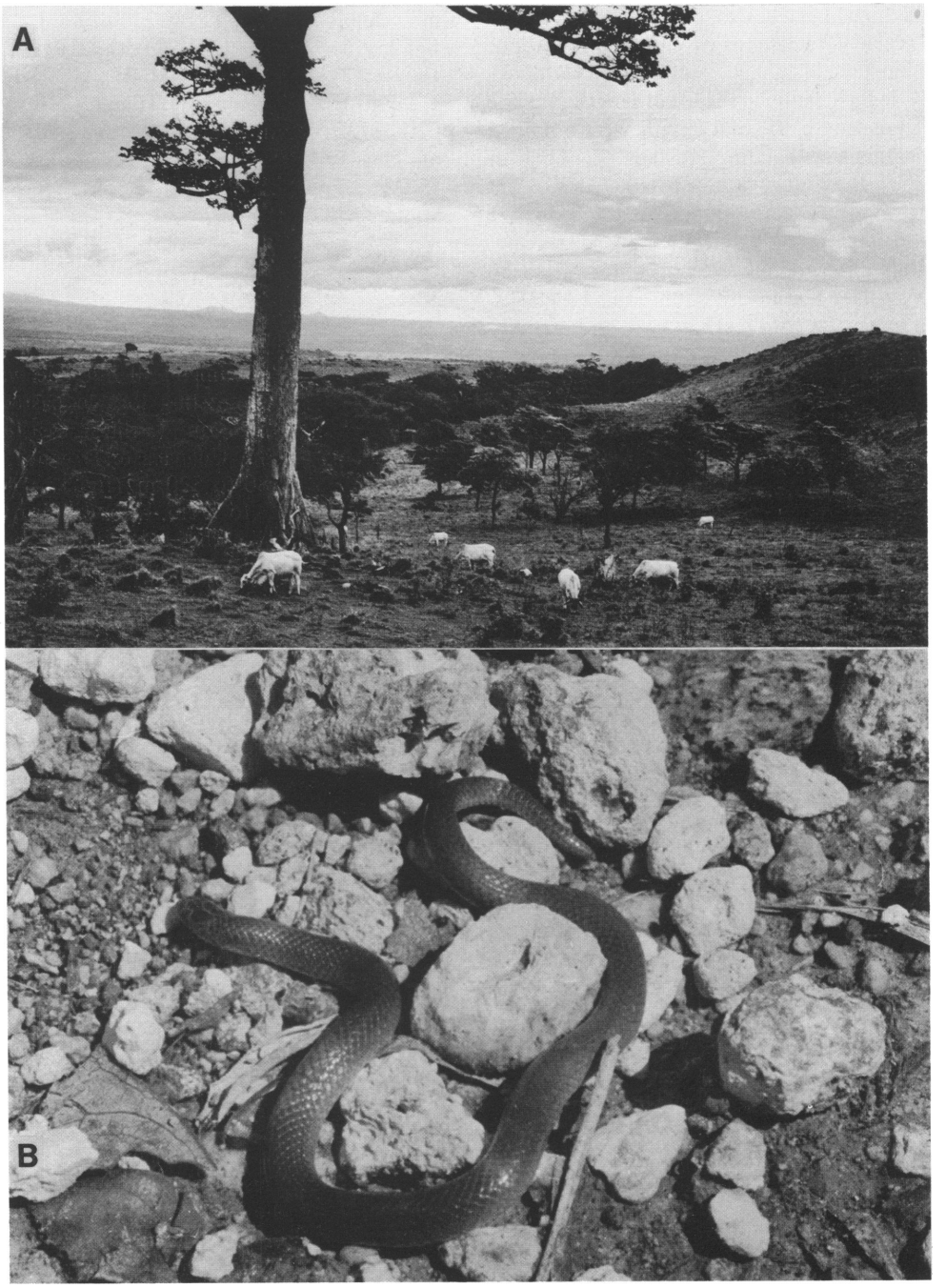

FIG. 1. Habitat of *T. vermiformis*. A. Pasture 1 km. E Los Angeles de Tilarán, Guanacaste Province, Costa Rica, elevation 500 m. Twenty-four specimens were found in or under logs in this and adjacent pastures. B. Male *T. vermiformis*, CRE 2217, from 5.5 km. NW Cañas, Guanacaste Province, Costa Rica, elevation 50 m. The gravel is similar to soil near the point of capture.

one plant) were identified: three lepidopteran larvae (from the La Pacifica specimen), one ?scarabaeid larva, one ?lampyrid larva, and one grass seed. The stomachs of seven specimens were empty or contained a granular substance similar to frass or soil. Apparently *T. vermiformis* feeds primarily, perhaps exclusively, on soft-bodied invertebrates, as do other species of *Tantilla* (see Wright and Wright, 1957, for a summary).

Several species of reptiles were collected at the same localities as the *T. vermiformis*. The Los Angeles site also produced the snakes *Enulius flavitorques* (Cope, 1869), *Ninia sebae* (Duméril, Bibron, and Duméril, 1854), *Micrurus nigrocinctus* (Girard, 1854), *Stenorrhina freminvillii* Duméril, Bibron, and Duméril, 1854, and the lizards *Gymnophthalmus speciosus* (Hallowell, 1860), *Ameiva undulata* (Wiegmann, 1834), *Coleonyx mitratus* (Peters, 1863), *Anolis cupreus* Hallowell, 1860, and *Ctenosaura similis* (Gray, 1831); the snake *Anomalepis mexicanus* Jan, 1860, was taken in a nearby pasture. The La Pacifica site produced the snakes *Leptotyphlops albifrons* (Wagler, 1824), *Conophis lineatus* (Duméril, Bibron, and Duméril, 1854), *Tantilla armillata* Cope, 1876, and the lizards *Gymnophthalmus speciosus*, *Ameiva undulata*, *Anolis cupreus*, *Anolis sericeus* Hallowell, 1856, *Iguana iguana* (Linnaeus, 1758), *Ctenosaura similis*, and *Sceloporus variabilis* Wiegmann, 1834.

COLORATION

The Costa Rican specimens show little variation in color and pattern and agree with previous descriptions in most details. The dorsum is stippled brown with darker areas around the edges of each scale (fig. 2). Pigment is concentrated in the center and anterior end of the scales of the vertebral row, producing the dark middorsal stripe seen on all specimens. The head is somewhat darker brown than the dorsum, with lighter tan areas on the snout and parietals. A dark brown ring surrounds the eye. The infralabials have brown centers. The venter is immaculate white or pale yellow. The pale pink ventral color reported by Wilson and Villa (1973) was not seen on Costa Rican snakes. Contrast in the color pattern is better developed on young animals than on larger, darker individuals.

SCUTELLATION

Head scales are simple and unmodified (fig. 2). The rostral is visible from above where its length is 0.16-0.53 (0.31 ± 0.02, N=17) its width. Paired internasals and prefrontals are much wider than long. Frontal length is 1.17-1.48 (1.35 ± 0.02, N=18) times its width. Length of the parietal is 1.59-1.95 (1.78 ± 0.02, N=18) times its width. The supraocular is single with length 0.80-2.7 (1.70 ± 0.10, N=18) times its width. The third and fourth of seven supralabials enter the orbit. There are six infralabials, with the anterior pair separated by medial contact of the anterior genials and mental. There are two postoculars and one preocular, which is usually (17 of 18 individuals) in contact with the postnasal. The exceptional specimen is UMMZ 135259-OP 4274, on which the prefrontal is in contact with the second supralabial on only one side, separating the preocular and postnasal on that side. The

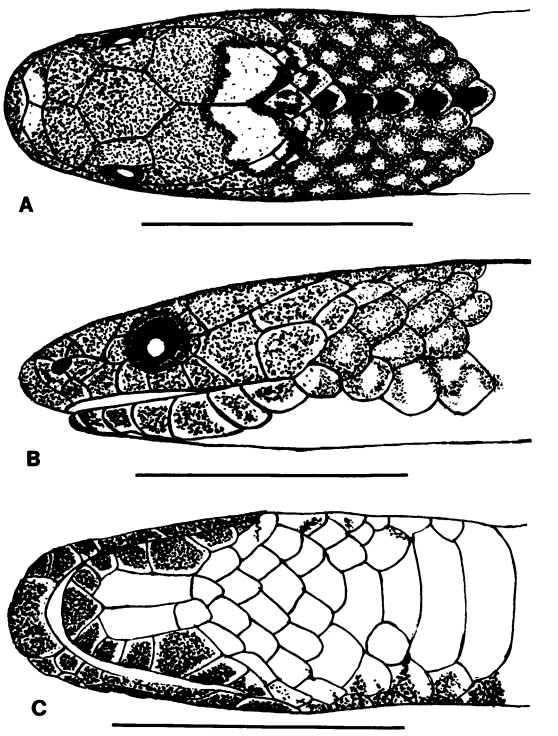

FIG. 2. Head of *T. vermiformis*, UMMZ 131399. A. Dorsal aspect. B. Lateral aspect. C. Ventral aspect. Heavy lines represent 5 mm.

naris is predominantly in the anterior of the two nasals. An elongate secondary temporal is always present, but the anterior temporal may be present on both sides (N=8), fused with the sixth supralabial on both sides (fig. 2B; N=13), or fused with the sixth supralabial on one side only (N=4). Four infralabials abut the anterior, larger genials. Males have significantly fewer ventrals and more subcaudals than females, but the sum of ventrals and subcaudals is the same in both sexes (table 1). The anal plate is divided on all snakes.

PROPORTIONS

Tantilla vermiformis has a very short tail comprising about 0.135 of the total length in Costa Rican males (table 1). Females have significantly shorter tails yet, with an average ratio of 0.107. The head is conical and not distinct from the neck (fig. 2A). Eyes are small, their length only 0.32-0.44 (0.39 ± 0.008, N=17) the length of the snout. Distance from the nostril to tip of the snout is 0.20-0.36 (0.30 ± 0.011, N=17) the distance from the eye to the tip of the snout.

OSTEOLOGY

Smith (1941, 1942) called attention to the importance of maxillary dentition in *Tantilla*. We agree that maxillary tooth counts are useful and extend this to the other dentigerous bones. We also note that other aspects of the skull may be very useful and we illustrate a skull (fig. 3).

Maxillae of Costa Rican *T. vermiformis* bear 13-15 (13.9 ± 0.153, N=15) functional teeth, including the two posterior fangs on each side. The fangs are small and separated from the anterior teeth by a short diastema. They are faintly grooved (fig. 3B) and displaced laterally on the maxilla. Each palatine-pterygoid complex bears 23-25 (N=2) teeth, and there are 13 or 14 (N=2) mandibular teeth.

Because *Tantilla* vertebrae have not been described in detail, we describe vertebrae of *T. vermiformis* here (figs. 4, 5), using the characters and terminology of Auffenberg (1963). The neural spine (fig. 4A, B) is short and does not overhang the neural canal. On some vertebrae there are small paired projections from the anterior end of the neural spine. The haemal keel is

TABLE 1
Comparisons Between Populations and Sexes of *Tantilla vermiformis*

Character	Group	N	Range	Mean	SE	M[a]-F[b]	CR[c]-Nic[d e]
Ventrals (V)	CR-M	14	117-123	120.6	0.51	S[f]	S
	CR-F	11	120-129	124.5	0.79	S	–
	Nic-M	4	115-119	118.0	1.00	–[g]	S
Subcaudals (SC)	CR-M	13	23-26	24.7	0.29	S	S
	CR-F	11	19-23	20.6	0.39	S	–
	Nic-M	4	25-27	26.0	0.41	–	S
V + SC	CR-M	13	141-147	145.2	0.55	NS[h]	NS
	CR-F	11	140-150	145.2	0.94	NS	–
	Nic-M	3	141-146	144.0	1.53	–	NS
Tail length / total length	CR-M	13	0.122-0.144	0.135	0.002	S	NS
	CR-F	11	0.096-0.118	0.107	0.002	S	–
	Nic-M	3	0.136-0.145	0.141	0.003	–	NS
Primary temporals[i]	CR	25	0-2	0.80	0.18	–	S
	Nic	5	2	2.00	0.	–	S
Maxillary teeth	CR	15	13-15	13.9	0.15	–	NS
	Nic	3	13-15	14.0	0.32	–	NS

[a] Male.
[b] Female.
[c] Costa Rica.
[d] Nicaragua.
[e] Only males are compared in this column.
[f] Significant at the 95% confidence level.
[g] No statistical comparison made.
[h] Not statistically significant.
[i] Both sides counted.

poorly developed (fig. 4B, C) but occurs as a flattened ridge that does not project beyond the condylus. Accessory processes (fig. 4C) are acute to acuminate and well developed. The paradiapophysis bears one articular surface and is not projected anteriorly. The zygosphene is crenate (fig. 4C), and the prezygapophysial articular surface is obovate. Diagnostic ratios for midbody vertebrae of *T. vermiformis* are presented in table 2. Preliminary comparisons with other species of *Tantilla* indicate that these ratios will become significant in understanding relationships within the genus, but these analyses are beyond the scope of this paper.

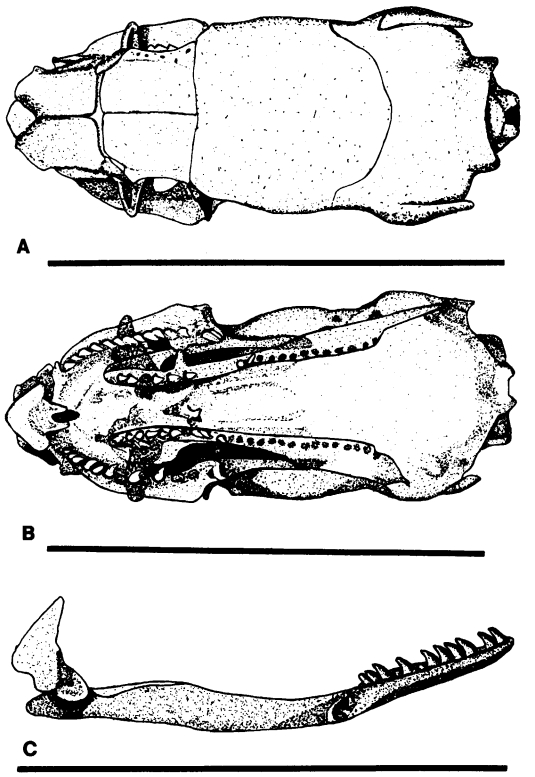

FIG. 3. Skull of *T. vermiformis*, UMMZ 135260. A. Dorsal aspect. B. Ventral aspect. C. Lingual aspect of mandible. Heavy lines represent 5 mm.

HEMIPENIS

The size of this organ in *Tantilla*, which approximates 5 mm. in adults of *T. vermiformis*, in no way reflects its importance. Telford (1966) concluded that hemipenial characters are useful in distinguishing species in the southeastern United States, and Cole and Hardy (unpubl. data) found them to be of critical importance in distinguishing species in the southwestern United States and northern Mexico. We describe the hemipenis of *T. vermiformis* in detail here, anticipating that it will be of systematic significance in the future when comparative data are available for other species.

We examined hemipenes on 10 males with everted or partly everted organs, but many characters were not observable on all specimens since degree of eversion varied. The hemipenis is single and subcylindrical (fig. 6). Fully or essentially fully everted organs extend to caudal number 6

TABLE 2
Diagnostic Ratios for *Tantilla vermiformis* (UMMZ 133892-OP 6464) Vertebrae

Character	N	Range	Mean	SE
cl/naw[a]	25	1.46-1.81	1.66	0.020
cl/col	25	5.07-7.40	6.00	0.124
cl/zt	25	14.8-25.3	18.8	0.422
nlu/nls	25	1.00-1.14	1.02	0.007
naw/po-po	25	0.55-0.60	0.57	0.003
nlu/nh	25	4.4-14.7	8.08	0.459
ctw/cth	25	1.05-1.61	1.23	0.028
zw/naw	25	0.95-1.05	1.00	0.005
zw/cl	25	0.55-0.70	0.61	0.008
pr-pr/po-pr	22	0.90-1.13	0.96	0.013
pr-pr/naw	22	1.71-1.88	1.79	0.009

[a]Abbreviations are those of Auffenberg (1963).

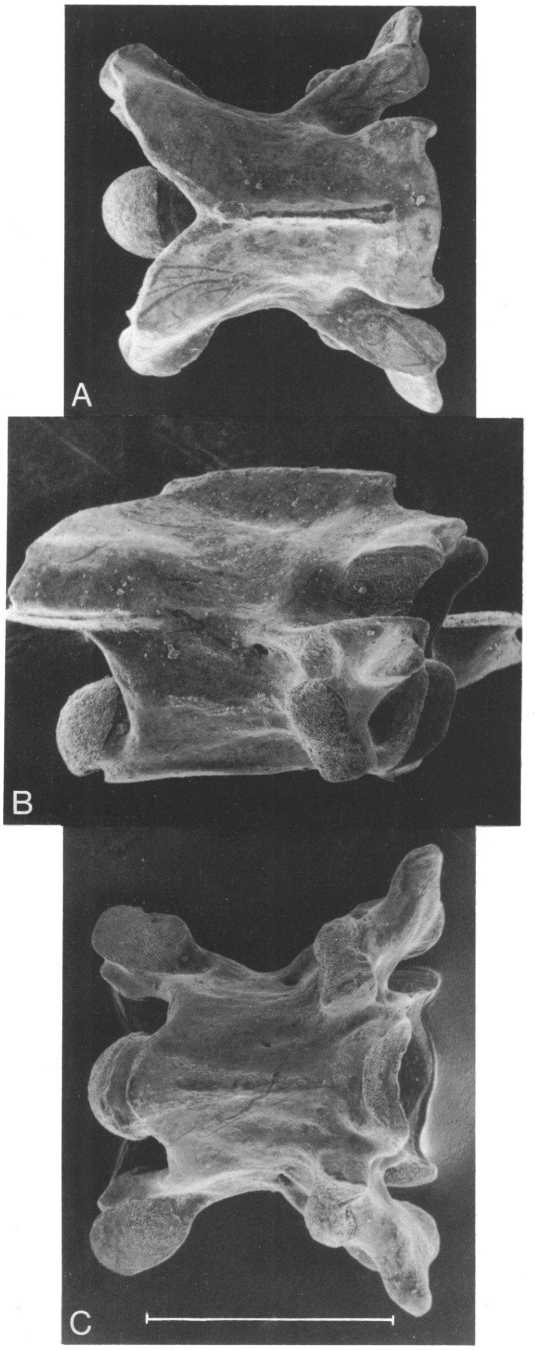

FIG. 4. Scanning electron micrographs of mid-body vertebrae of *Tantilla vermiformis*, UMMZ 133892-OP 6466. Views are: A, dorsal; B, right lateral; C, ventral; light line represents 1 mm.

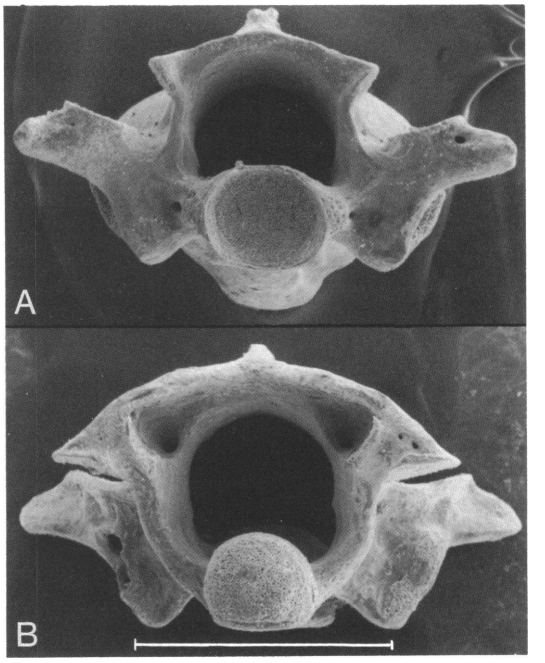

FIG. 5. Scanning electron micrographs of mid-body vertebrae of *Tantilla vermiformis*, UMMZ 133892-OP 6466. Views are: A, anterior; B, posterior; light line represents 1 mm.

(counting posteriorly from the vent; N=3) or caudal 7 (N=1). For orientation, consider that the apex of the everted organ is directed downward from the snake at 90 degrees to the vent. The *sulcus spermaticus* is simple and emerges from the vent on the medial aspect of the organ, twists posteriorly rather abruptly to the posterior aspect, and continues to the apical region, with a slight twist toward the lateral aspect, terminating somewhat proximal to the apex (fig. 6A; mostly untwisted). The base of the organ (more than one-third) is naked, excepting inconspicuous longitudinal wrinkles and a fleshy ridge bearing a fleshy papilla on its apical end, on the asulcate aspect (fig. 6B). This papilla is situated at the distal end of the basal region, at caudal number 2 (N=8) or 3 (N=2). Apical to the basal region is a spinose medial region with densely distributed spines and spinules that number in excess of 100 and perhaps 200, arranged approximately in bands encircling the organ but broken at the *sulcus spermaticus*. The basalmost spines are the

largest and generally are not situated on calyces, although some are. The distalmost spines and spinules are on calyces, and there is a gradual transition from the non-calyculate to the calyculate area within this medial spinose region. Some of the calyces on the asulcate aspect are particularly broad, perhaps qualifying as short, spinulate flounces. The organ is capitate, and the apical region is nude except for longitudinal folds or wrinkles, which suggest that it may become somewhat bulbous if injected more. The organs on opposite sides of the body are mirror images of each other. Origin of the *m. retractor penis magnus* is at caudals 21-25 (23.3 ± 0.47, N=10), which is among the last three caudals on all individuals.

CHROMOSOMES

We examined chromosomes from a total of 17 dividing cells (two mitotic, 15 meiotic, including 10 primary and five secondary spermatocytes) from bone marrow and testicular tissues of two males. The diploid number is 36, of which 16 are macrochromosomes and 20 are microchromosomes (figs. 7, 8). Considering the macrochromosomes in order of decreasing size, numbers 1, 3 and 4 are metacentric, numbers 2 and 5 are submetacentric, number 6 is subtelocentric, and numbers 7 and 8 are submetacentric to subtelocentric. Shape of the microchromosomes usually cannot be resolved, but in one cell one clearly was metacentric and in another cell two were bi-armed. No satellites, secondary constrictions or hetermorphic pairs were observed.

COSTA RICA-NICARAGUA COMPARISONS

The Costa Rican snakes are clearly referable to the Nicaraguan *T. vermiformis*, yet they differ from them in several ways. Males from Nicaragua[1] have fewer ventrals and more subcaudals (table 1). Costa Rican specimens tend to have fewer primary temporals (table 1) and never have

[1]Wilson and Villa (1973) reported a specimen (Jaime Villa no. 7178) as the first known female of *T. vermiformis*. Examination of this specimen by one of us (R.W.V.) revealed well-developed hemipenes, demonstrating that it is a male.

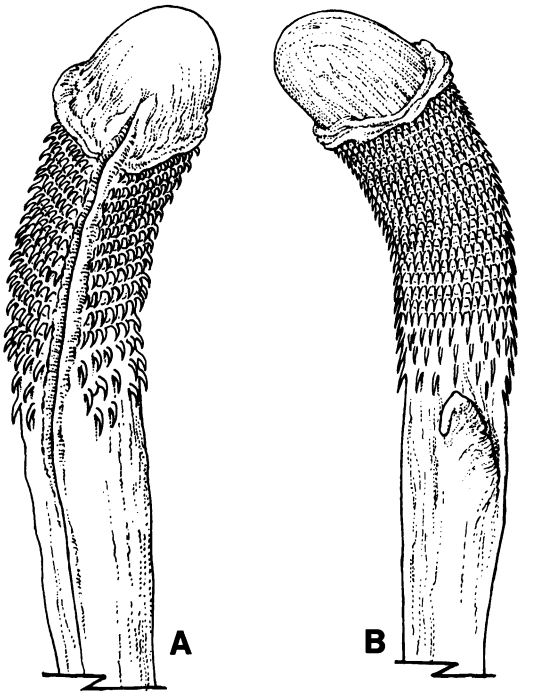

FIG. 6. Hemipenis of *Tantilla vermiformis*, UMMZ 138224. A. Sulcate aspect. B. Asulcate aspect. Actual length of organ illustrated is approximately 5 mm.

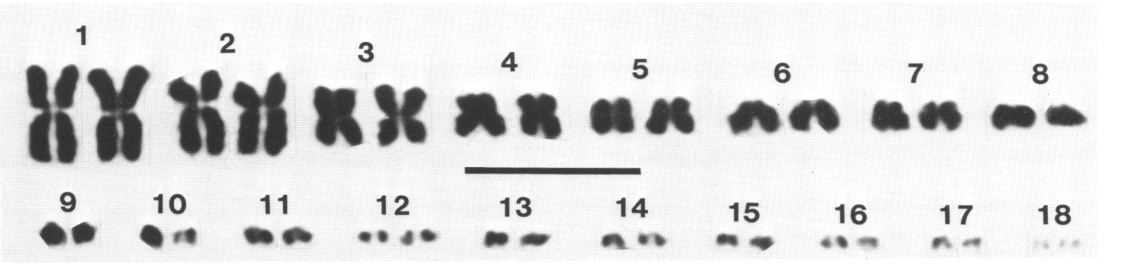

FIG. 7. Diploid karyotype of *Tantilla vermiformis*, AMNH 111325, male. Vertebral bone marrow preparation. Line represents 10 μ.

FIG. 8. Chromosomes of *Tantilla vermiformis*, AMNH 111326, male, from a primary spermatocyte at diakinesis.

the pink ventral coloration reported by Wilson and Villa (1973). Other characters of coloration, body proportions and dentition of the two populations are identical.

DISCUSSION

Several recent studies revealed that certain characters used to distinguish among species of *Tantilla* may vary considerably within local populations. For example, the number of maxillary teeth, supralabials, infralabials and temporals, as well as contact between postnasal and preocular or between anterior genials and mental vary in the species from the southeastern United States (Telford, 1966). Whereas most of these characters varied in only a few snakes, 15 to 73 percent of all specimens varied from local "norms" in at least one character. Tanner (1966) reported variation in the number of temporals and contact between preocular and postnasal or between genials and the mental in populations related to *T. planiceps*. The contact characters also are variable in populations related to *T. taeniata* (see Wilson and Meyer, 1971). Hardy and Cole (1968) examined 256 specimens of *T. gracilis* from a restricted area in Kansas and found that only 51.2 percent were "typical" for 10 scale characters, whereas 12.7 percent were atypical in more than one character. These results emphasize the need for thorough understanding of variation in series of animals when interpreting relationships in *Tantilla*, a genus that contains numerous species known from few specimens and defined by characters known to vary intraspecifically.

Tantilla vermiformis apparently is less variable than the species cited immediately above, for most of the scale characters showed no variation. Of the nine characters considered by Hardy and Cole (1968) excluding temporals, only two of 212 snake-characters (nine characters, 25 snakes, 13 missing observations) were atypical in *T. vermiformis*. In other words, only one snake in 106 is expected to be aberrant in scale counts excluding temporals. Presence of an anterior temporal is so variable in Costa Rican *T. vermiformis* that the mean is a total of 0.8 anterior temporals when both sides are considered.

Coloration also is conservative in *T. vermiformis*. All snakes examined had the same pattern of a dark middorsal stripe and light areas on the parietals and snout. Variation occurred primarily in the contrast between these markings and the ground color, which varies ontogenetically (less contrast as snakes darken with age).

Our observations support previous conclusions that *T. vermiformis* is quite distinct from other species of *Tantilla*. Apparently it belongs to a group of four small species, including *T. brevicauda* Mertens, 1952, *T. brevis* (Günther, 1895), *T. canula* Cope, 1875 and *T. vermiformis*, distributed from southern Mexico to Costa Rica. Available data comparing these species are presented in table 3. *Tantilla vermiformis* is thought to be most closely related to *T. canula*, which is close to *T. brevis* (see Cope, 1875; Smith, 1942; Stuart, 1958; Neill and Allen, 1961). It can be separated from these species by the absence of a dark middorsal stripe in *T. brevis* and by the presence of a middorsal light stripe in *T. canula*. They also differ in number of ventrals and subcaudals. Stuart (1958) argued that *T. brevis* (*breve* in his usage) is conspecific with *T. canula*. This arrangement is followed by Neill and Allen (1961), who treated *T. brevis* as a subspecies of *T. canula*. Arguments in both these works were based, in part, on four specimens (now UMMZ 117905-117908) from Tikal, Guatemala, which have been reidentified by one of us (R.W.V.) as *Tantillita lintoni*. Thus, the specific relationship of *T. brevis* and *T. canula* remains unresolved.

TABLE 3
Variation in Species of *Tantilla* Apparently Related to *Tantilla vermiformis*

Character	*brevicauda*[a]	*brevis*[b]	*canula*[c]	*vermiformis*[d]
Ventrals (V)	139-155	108-111	105-114	117-129
Subcaudals (SC)	21-26	?	34-43	19-26
V + SC	164-177	?	140-147	140-150
Supralabials	7	7	7	7
Infralabials	6-7	6	6-7	6
Body length (mm.)	71-148	*ca.* 125	74-135	63-153
Maxillary teeth	?	?	15	13-15
Tail/total length × 100	0.099-0.110	?	0.193-0.215	0.096-0.145
Light collar	yes	no	no	no
Middorsal dark stripe	no	no	no	yes
Left oviduct	?	?	?	vestigial
Sample size	8	1	4	32

[a] Data from Mertens, 1952a, b; Uzzell and Starrett, 1958; Wilson, 1970.
[b] Data from Günther, 1895 (1885-1902); Neill and Allen, 1961.
[c] Data from Cope, 1875; Smith, 1941, 1942; Schmidt and Andrews, 1936; Neill and Allen, 1961; Duellman, 1965.
[d] Data from present study.

Tantilla brevicauda is similar to the other three forms, differing from them in having more ventrals, a light collar, and several indistinct dark and light stripes (Mertens, 1952a).

Current material for most of these forms is inadequate to determine relationships with much confidence. Additional specimens and information about osteology, hemipenial morphology, and possibly karyotypes may further improve our understanding of the systematics of these secretive snakes.

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