

***CROTALUS UNICOLOR* (VAN LIDT DE JEUDE), ARUBA ISLAND RATTLESNAKE**

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Contents: Historical - Taxonomic status - Phylogeny - Description - Scalation - Size-Longevity - Range - Habitat - Food - Habits-Behavior - Venom - Reproduction - Status - Acknowledgements - References.

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HISTORICAL

The Aruba Island rattlesnake was first described in 1887 by Van Lidt de Jeude as *Crotalus horridus* variation *unicolor*. The type locality was given as 'Aruba,' referring to Aruba Island, Netherlands Antilles (also called Dutch West Indies). Van Lidt de Jeude's original description was actually based on 4 specimens, two of which were preserved specimens and two of which were alive at that time but are now considered cotypes (Brongersma, 1940).

The specific name '*unicolor*' is derived from two Latin words; *unus* (one) and *color* (color) (Brown, 1978). This name refers to the faded and almost uniform color and pattern of adult specimens.

TAXONOMIC STATUS

Even today, there is still controversy over whether the Aruba Island rattlesnake is a distinct species, or simply a subspecies of *Crotalus durissus*. Since a majority of herpetologists seem to regard this rattlesnake as a distinct species, as does this writer, I have elected to give this snake full species status in this article. As I mentioned in my article on *Crotalus durissus vegrandis*, the entire '*durissus*' group of rattlesnakes is in need of revision (Strimple, 1987). It is hoped that the forthcoming publication by Campbell & Lamar (in press) will provide information which will clarify the taxonomy of these rattlesnakes as a group, and *Crotalus unicolor* in particular.

Perhaps the most important and interesting controversy associated with *Crotalus unicolor* is the true identity of a rattlesnake described by Ditmars (1905), as *Crotalus pulvis*. The type specimen was reportedly collected '20 miles inland from Managua, Nicaragua, in a dry, sandy region' (Ditmars 1941). The coloration of this specimen (uniform blue-gray) and the adult size (slightly over 90 cm) are strikingly similar to known specimens of *Crotalus unicolor*. Gloyd (1936) considered these, as well as other, similarities and subsequently placed *Crotalus pulvis* in synonymy with *Crotalus unicolor*. Shortly thereafter, Klauber (1936b) also questioned the identity of *Crotalus pulvis* stating that it was 'probably based on an albino *Crotalus durissus durissus*, but might be *Crotalus unicolor*.' Further support for this synonymy was given by Ditmars, in a letter to Gloyd, who stated '... I agree that the Central American locality now seems incongruous, particularly in the face of *Crotalus unicolor* being well established for Aruba, with no other verifying records from Central America' (Gloyd, 1940). Other authors have questioned the identity of *Crotalus pulvis*, including Hoge (1966) and Hoge & Romano Hoge (1981).

The affinity of *Crotalus unicolor* to the *durissus* group, and in particular to *Crotalus durissus terrificus*, has been known almost since the time of its original description. Meek (1910) and Ruthven (1923) both listed the rattlesnakes from Aruba Island as *Crotalus terrificus*. Amaral (1929b) stated that *Crotalus pulvis* Ditmars was in fact 'an albinistic specimen of *Crotalus terrificus*', while Brongersma (1940) considered *Crotalus pulvis* to be 'an aberrant specimen of *Crotalus durissus durissus* L.' Ditmars (1941) later concluded that his type specimen of *Crotalus pulvis* was an albino *Crotalus terrificus*.

Since its original description, the Aruba Island rattlesnake has been given a distinct species status, *Crotalus unicolor*, by numerous authors, including; Gloyd (1940), Harding & Welch (1980), Harris & Simmons (1972a, 1972b, 1977, 1978), Kauffeld & Gloyd (1939), and Klauber (1936a, 1936b, 1937, 1956, 1972), Phelps (1984), Rosenberg (1987), and Tu (1982).

There have been, however, many authors who have only given this rattlesnake a subspecific status, thereby listing it as *Crotalus durissus unicolor*. These authors include; Brattstrom (1964), Brongersma (1940), Brown (1973), Hoge (1966), Hoge & Romano Hoge (1981), Kilmon & Shelton (1981), Perkins (1951), and Peters & Orejas-Miranda (1970, 1986).

PHYLOGENY

Phylogenetic 'trees' can be useful tools which may help to clarify the origin and relationships of various animals by showing the evolution of that group. Diagrams depicting the phylogeny of *Crotalus unicolor*, as well as other species in the genus *Crotalus*, can be found in Amaral (1929a), Brattstrom (1964), Gloyd (1940), and Klauber (1956). Stille (1987) also showed the relationship of *Crotalus unicolor* to other members of the genus *Crotalus*. In this study, the author used cladogram, based on data collected from studies done on dorsal scale microdermataglyphics, to show interspecific relationships.

DESCRIPTION

Most adult specimens of *Crotalus unicolor* appear as uniformly colored snakes, with little or no pattern. The pronounced spinal ridge, which is so characteristic of the '*durissus*' group of rattlesnakes, is reduced in this species, especially in juveniles.

Aruba Island rattlesnakes typically occur in two basic color phases. In one, the ground color can be pale gray to bluish-gray, in the other it can be brown or pale grayish-brown. Klauber (1936) states 'General color white, cream, or yellow, with grayish.' Peterson (pers. comm.) has seen specimens at the Houston Zoo which had a very distinct light, brownish-orange ground color, and Van Deventer (pers. comm.) has seen specimens that had a reddish or cinnamon colored dorsal surface. Even those specimens that are exceptionally colorful will undergo an ontogenetic fading of their coloration. In addition to the uniform ground color of most specimens, there is frequently a varying amount of darker gray pigment, occurring as a fine stippling or speckling. Often times, the lower sides of the body are a pinkish or pinkish-orange color.

If a dorsal pattern is at all discernible in adults, it consists of faint, rhomboidal blotches which are gray or grayish-brown in color. These blotches are usually outlined with a single (sometimes double) row of white scales. When present, dorsal blotches can range in number from 18-28, with the average being around 23-24. Juvenile specimens of this rattlesnake, however, usually have a distinct dorsal pattern. In some specimens, the blotches are light brown in the center, darker brown at the edges and distinctly edged in white. Often times, a series of secondary blotches can be seen laterally, between the primary blotches. Variation in the dorsal pattern does occur, as evidenced by a female specimen, described by Brongersma (1940), which had dark, chevron

shaped blotches, that were bordered with light colored scales. Another variation has been observed on pale or light-colored specimens (Van Deventer, pers. comm.). This pattern anomaly is an apricot-colored mid-dorsal stripe, approximately 3 scales in width.

The head coloration of adults generally matches that of the ground color. Occasionally, a pattern of small blotches or punctuations of darker gray pigment may be visible. In juveniles a distinct head pattern is often present in the form of light colored crossbars across the frontal scales, as well as a dark postocular stripe. Paravertebral stripes may also be present (in most juveniles and some adults), usually extending from 1-3 head lengths onto the neck. Peterson (pers. comm.), however, has observed juvenile specimens which had paravertebral stripes that extended onto the body for up to 1/3 its length. Paravertebral stripes are usually brown in color and are separated by a median stripe that matches the ground color. A very detailed description of the color and pattern of a juvenile *Crotalus unicolor* can be found in Brongersma (1940).

The patternless ventral surface, of adults and juveniles, is typically white or cream colored. The subcaudal region is dark gray or grayish-black. Dorsally, the tail is a darker shade of gray than the ground color, changing to a bluish-black laterally. Frequently, from 3-6 crossbands can be distinguished on the tail of juveniles, but these will fade away by the time maturity is reached.

SCALATION

Typically, *Crotalus unicolor* have 27 scale rows at mid-body, with the range being from 25-27. The dorsal scales are keeled except for the first 1-3 rows. Subcaudal scale counts range from 26-31 (mean 28.5) in males and from 22-25 (mean 22.8) in females. Although these scales are normally single, there are some specimens in which the last few are divided. Ventral scale counts range from 155-164 (mean 159.0) in males and from 163-170 (mean 166.5) in females. These, as well as other detailed accounts of scalation in this species can be found in Brongersma (1940), Gloyd (1940), Kauffeld & Gloyd (1939), Klauber (1941, 1972), and McCranie (1986).

SIZE - LONGEVITY

The maximum total length of this species is generally accepted as 97.0 cm. This specimen, a male, had a snout-vent length of 87 cm and a tail length of 10.0 cm (Brongersma, 1940). Pope (1944) stated that the largest specimen had a total length of 95.25 cm, apparently being unaware of the former record length. Average adult specimens of the Aruba Island rattlesnake range between 60-80 cm in total length.

As is the case with many snakes, there have been a couple of reports of Aruba Island rattlesnakes that were considerably longer than the above record length. While these reports have not been documented with living or preserved specimens, they are worth noting. Considering that *Crotalus unicolor* is related to *Crotalus durissus*, and that some of these snakes attain lengths of 150-180 cm, it is not hard to believe that some *Crotalus unicolor* could attain lengths greater than 97 cm. Peterson (pers. comm.) informed me of a report that he received of a specimen that was seen by Julio Maduro (a prominent Aruba naturalist) in a well, in 1942 and was reportedly well over 122 cm and actually closer to 152 cm in total length. Moreover, Van Deventer (pers. comm.) mentioned a report he received of a specimen that was believed to be closer to 182 cm in total length. The lengths mentioned above were reported by local inhabitants of Aruba, and although they may seem highly improbable, they should not be discounted, as there is still much to be learned about the natural history of this rattlesnake.

A useful statistic that is often reported for rattlesnakes is the tail length/total length ratio. Typically, this value is reported as a decimal (occasionally as a %), and indicates what fraction

the tail length is of the total length. Although intraspecific ratios are generally within a narrow range, there can be considerable variation interspecifically. Tail length/total ratios for *Crotalus unicolor* can range from .101-.112 in males, and from .70-.088 in females. These values have been reported by, or can be calculated from data in Brongersma (1940), Gloyd (1936, 1940), Kauffeld & Gloyd (1939) and Klauber (1956).

Aruba Island rattlesnakes apparently do fairly well in captivity, as evidenced by a specimen from the San Diego Zoo which lived to the age of 14 years 10 months (Bowler, 1977). Peterson (pers. comm.) informed me of a specimen at the Houston Zoo that was known to be 14-15 years old at the time of its death, as well as a female specimen at the Brownsville Zoo which was believed to be 16-17 years old.

RANGE

Crotalus unicolor is endemic to Aruba island, which is located approximately 20 miles off the northwest coast of Venezuela, in the Caribbean Sea. Aruba is a small, volcanic island, covering roughly 70 square miles. It is one of several islands that comprise the Netherlands Antilles.

The actual distribution of this species on the island is limited to the southern end of the island. Peterson, after having talked to many islanders about this species' range, believes that the total area occupied by these rattlesnakes is between 7-10 square miles. (Peterson, pers. comm.). Hudson (1984) stated 'their home range has been reduced to only seven square miles of undisturbed habitat.'

The Aruba Island rattlesnake is not common on the island, although islanders have reported seeing it with some frequency. Porras (pers. comm.) mentioned that one person, who visited Aruba in 1986, was able to find a specimen of *Crotalus unicolor*. Other than this, the last few expeditions to Aruba, in search of this snake, have failed to produce a single specimen, although Odum (pers. comm) did find a couple of shed skins. Hudson (1984) stated that 'the rarity of *Crotalus unicolor* is due to human encroachment (oil company, tourist industry) as well as habitat destruction by the native goat population.' Odum (1987b) reported that 'The area where the existing population of *Crotalus unicolor* presently resides has been established as a natural area, and any modifications to the habitat (i.e. construction) are prohibited.'

HABITAT

Aruba is best described as an arid, dry, rocky region that is relatively barren. Paterson, who has been to this island twice, characterized the overall habitat has a very hilly, 'thorn scrub' association as defined by Sarmiento (1976). Some of the sparse vegetation on this island includes introduced species of agave and ocotillo (Peterson, pers. comm.). Reportedly, there is a short rainy season extending from November through March.

Some authors have pointed out that, in pre-columbian times, Aruba is believed to have actually been heavily forested or wooded (Klauber, 1956, Harris & Simmons, 1978). Klauber (1956), relating these reports, stated '... the trees were cut down for charcoal, and erosion has prevented reforestation.' Apparently, this can not be confirmed and there are some people who do not agree, believing, instead, that this region did undergo some deforestation, but was never 'heavily forested' (Peterson, pers. comm.).

Within their limited range on the island, *Crotalus unicolor* have frequently been found by islanders, during the rainy season, in the arroyos which are scattered amidst the hills (Peterson, pers. comm.). These people also reported that they frequently see these rattlesnakes lying on the branches of shrubs, 30-60 cm off the ground.

FOOD

Literature accounts of the food of this rattlesnake are surprisingly lacking. Klauber (1972) reported that wild *Crotalus unicolor* prefer rabbits and lizards. Peterson (pers. comm.) and Van Deventer (pers. comm.), while visiting the island in 1982, saw the highest concentrations of lizards (genera *Ameiva* and *Cnemidophorus*) that he had ever seen. They also reported seeing rabbits (endemic to Aruba) as well as mice around the local dumps and on the roads at night. Undoubtedly, these animals make up the majority of the diet of *Crotalus unicolor*. It should be pointed out that although there are no records of these snakes feeding on birds, or their young, it is a possibility especially since these snakes are seen in low branches where bird nests can be found (Peterson, pers. comm.). Nonetheless, captive specimens (both adults and juveniles) will feed readily on mice and rats.

HABITS - BEHAVIOR

Accounts of the disposition of these snakes can be found in Gloyd (1940), Kauffeld & Gloyd (1939), Klauber (1956), and Moore et al. (1968). These authors did not consider *Crotalus unicolor* to be aggressive, but did point out that it is ready to defend itself, especially if provoked. Peterson, who has worked with this species for several years, described their disposition as 'phlegmatic' (Peterson, pers. comm.).

In the last decade or so, various elapids, viperids, and crotalids have been used in studies dealing with behavior known as strike-induced chemosensory searching (abbreviated SICS). Two of these more recent studies, reported on by Chiszar et al. (1985) and O'Connell et al. (1982), used specimens of *Crotalus unicolor*, as well as other crotalids and viperids, as their subjects. The former study used long-term captives, while the latter used young specimens that were 12-18 months old.

Surprisingly, the Aruba Island rattlesnakes' worst enemy is not man, as is normally the case with some reptiles. Peterson (pers. comm.) has observed that the islanders do not kill these snakes when they encounter them in the wild. The primary enemies of *Crotalus unicolor* in the wild are predatory birds, such as the caracara (Peterson, pers. comm.).

VENOM

Considering its close affinity with *Crotalus durissus*, and especially *Crotalus durissus terrificus*, it does not seem unreasonable to assume that *Crotalus unicolor* possesses a potent venom that could be markedly neurotoxic in its action. In fact, recently, Glenn (pers. comm.) pointed out that the venom of *Crotalus unicolor* is very similar to that of *Crotalus vegrandis* and *Crotalus durissus terrificus*.

Literature accounts of the composition and toxicity of *Crotalus unicolor* venom are almost non-existent. Klauber (1956, 1972) suggested that these rattlesnakes were not among those species with a haemorrhagic venom. Glenn & Straight (1982) state 'we have been unable to locate any toxicological reports concerning *Crotalus unicolor*.' Fortunately, however, there are some forthcoming publications which will cover the components and toxicity of *Crotalus unicolor* venom (Glenn, pers. comm.).

Size, combined with venom potency, could make this a potentially dangerous species. Glenn & Straight (1982) stated 'the largest reported specimen is 95 cm (Klauber, 1956) and therefore should be considered dangerous, especially if venom toxicity is found to be similar to the *Crotalus durissus* forms.'

REPRODUCTION

Courtship (in captivity) in the Aruba island rattlesnake has been observed during the months of July through October (Carl et al., 1982). Actual copulation (in captivity) has been reported for the months of September and October (Carl et al., 1982, and Klauber, 1972).

Parturition (in captivity) has occurred during April, May, June, July, and September, with May and June being the most common months (Carl et al., 1982, Kauffeld & Gloyd, 1939, and Klauber, 1972). Brood size (including slugs and stillborns) can range from 2-15, the average, however, is usually 10 or below. Peterson (pers. comm.) pointed out that the brood sizes given by Carl et al. (1982) are noticeably smaller than those recorded by other authors, and believes that this is primarily a result of inbreeding that occurs in these specimens.

At birth (stillborns included), the neonates can range from 23-29 cm in total length. Kauffeld & Gloyd (1939) reported on a brood of twelve young at the Staten Island Zoo; five of the neonates were either born dead or died shortly after their birth (as did the mother), and seven additional young were removed from the female after her death. Measurements on four of these neonates (one male, three females) were as follows; one male had a total length of 20.1 cm while three females ranged from 18.7-20.5 cm in total length. All twelve of the above young were believed to be premature, as the hemipenes were everted on the males at the time of their birth.

Klauber (1956), and Perkins (1951) described the results of an accidental hybridization which occurred between a female *Crotalus unicolor* (Perkins used the name *Crotalus durissus unicolor*) and a male Mojave rattlesnake, *Crotalus scutulatus scutulatus*, at the San Diego Zoo. No copulation date was given, however, the female gave birth to four neonates (three males and one female) on 10 June 1948. The resultant offspring, which more closely resembled the father, were maintained in captivity for at least six years. In 1950, courtships in these hybrids was observed in October, and a mating took place on 9 November. The female of this brood (now approximately two years and eight-and-a-half months old) subsequently gave birth to five live young, as well as one stillborn and one infertile egg, on 28 April 1951 (Perkins, 1951). In the following years, this female gave birth to four additional broods which ranged in size from 5-14 (including stillborns and infertile eggs). Additional data for these broods can be found in Klauber (1956, 1972).

STATUS

The Aruba Island rattlesnake was listed as a threatened species by the United States Fish and Wildlife Service on 22 June 1983, and its current status has remained unchanged (U.S. Gov., 1987).

Currently, the Aruba Island rattlesnake is receiving the attention of the Species Survival Plan (SSP) which is a program developed by the American Association of Zoological Parks and Aquariums (AAZPA). Originally, there were five species of reptiles that were included in the SSP program, one of which was the Aruba island rattlesnake (Hudson, 1984). Peterson (pers. comm.) was the person responsible for petitioning the SSP for the inclusion of this rattlesnake in the program, and in late 1982 it was accepted.

Each species in the SSP program has a Species Coordinator and a Studbook Keeper. Andrew Odum, the Species Coordinator for the *Crotalus unicolor* SSP program, stated that 'One of the ultimate goals of any SSP program is to be a resource that can be used to support conservation programs for the wild population of the species' (Odum, 1987b).

One of the responsibilities of any SSP program is to monitor the captive populations. Odum (1987b) stated that 'the total living captive population of *Crotalus unicolor* listed in the studbook database is 107 animals (50 males and 52 females, 5 unknown sex)', which are maintained in 12 different institutions (Odum, 1987b).

Odum (1987b) reported that the founder stock of this species consisted of six specimens which were 'imported in the early seventies' and that one of the two founder females has yet to reproduce in captivity. As a result, inbreeding has occurred and will continue to occur, unless additional, unrelated *Crotalus unicolor* are obtained from the wild (Odum, 1987b). There are plans for the Houston Zoo to attempt to import two pairs of *Crotalus unicolor* in the future, but this will not be done until the end of the study mentioned below (Odum, 1987b).

Odum (1987a, 1987b, pers. comm.) has reported on the plans for a one year study of this rattlesnake in the wild. The objectives of this study are given by Odum (1987a) as 1) study the life history of *Crotalus unicolor* in its natural habitat, 2) to determine the number and current status of the population. Part of this project will include tracking studies using snakes with surgically implanted transmitters (Odum, 1987a, pers. comm.).

It should be pointed out that the captive population of Aruba island rattlesnakes has suffered some losses due to a paramyxo virus. This virus, which has affected viperid and crotalid collections across the country, is extremely contagious, and often fatal. Jacobson (pers. comm.) and Gaskin (pers. comm.) expressed concern over, and cautioned against, the release of captive specimens of *Crotalus unicolor* into the wild if they have either not been tested or have tested positive for this virus. Even though this virus, in all probability, came from the wild (Gaskin, pers. com.), the release of captive *Crotalus unicolor* into the wild population (which has not been tested) would seem unadvisable at this time, especially if one considers the limited range of this species and the deleterious effects the virus could have on the wild population.

ACKNOWLEDGEMENTS

I am very grateful to Karl Peterson, of the Herpetology Department at the Houston Zoo, for providing me with information he obtained from his trips to Aruba, in July and December, 1982. This information has been invaluable to the writing of this article. Furthermore, Karl provided me with information he obtained from maintaining this species in captivity for many years. Andrew Odum, also from the Houston Zoo, provided me with copies of two papers pertaining to his work with this species and the SSP programs, and also discussed the status of this rattlesnake and the plans for the upcoming study on Aruba. I would also like to thank Dr. James Glenn of the Venom Research Laboratory, in the Veterans Administration Medical Center (Utah), for discussing, with me, the venom of this species. Terry Van Deventer, who visited Aruba with Karl Peterson in December 1982, kindly supplied me with information on the natural history of this species and the island it is found on, pertaining to his trip to Aruba, with Karl, in December 1982. I am also thankful to Louis Porras, of Zooherp Inc., who discussed, with me, his observations on captive specimens of this species, as well as the report of the specimen found in 1986. Finally, I am indebted to Dr. Elliot Jacobson, and Dr. Gaskin, both of the College of Veterinary Medicine, at the University of Florida (Gainesville), for the information they provided about paramyxo virus and its effects.

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N.B.: This article has been published earlier in *The Forked Tongue*, Vol. 12, 1987.