

The snail-eating snake *Dipsas variegata* (Duméril, Bibron and Duméril) on Trinidad, and its relationship to the microcephalic *Dipsas trinitatis* Parker (Squamata, Dipsadidae)

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The most complete review of the snail-eating snake genus *Dipsas* was Peters (1960), who recognized 32 species, categorized into seven species groups based primarily on colour pattern. Peters and Orejas-Miranda (1970) revised the genus to include 28 species. Today 36 species of *Dipsas* are recognized (Uetz & Hošek, 2014). Of the known species, 28 are South American, five are Central American and three are Mexican. One species, *Dipsas trinitatis* Parker is known only from Trinidad. The purpose of this paper is to document the presence of *Dipsas variegata* on Trinidad and discuss the morphology that separates the two species.

The original description of *Dipsas trinitatis* (Parker, 1926) was based upon a single male specimen from the Trinity Hills of southern Trinidad and a second specimen without locality data. Parker recognized its close relationship to mainland South American *Dipsas variegata*. Parker distinguished the two species using the presence/absence of a preocular, the number of upper labials, and differences in colour pattern, characters now known to be variable in both taxa. In his review of dipsadine snakes, Peters (1960) relegated *D. trinitatis* to a subspecies of *D. variegata* based on colour differences from the mainland populations. Emsley (1977), Murphy (1997) and Boos (2001) followed this recommendation and discussed this snake as *D. v. trinitatis*.

Until now, all references to *Dipsas* on Trinidad have referred to *Dipsas trinitatis* Parker. Here we report the presence of *Dipsas variegata* on Trinidad. A single female specimen, identified as *Dipsas trinitatis*, was found in the collection of The National Museum and Art Gallery of Trinidad & Tobago (Inventory No.

SS92/8001.163) and now stored in The University of the West Indies Zoology Museum (UWIZM). Its large size (796 mm total length, 607 mm SVL), bulky head, tall upper labials, an eye diameter that is about equal to the eye-mouth distance readily distinguish it from its congener, *Dipsas trinitatis*. The specimen agrees well with all 16 diagnostic characters for the species listed by Harvey and Embert (2008). Collection data accompanying the specimen reads, "Commander Ian Cross, found at Macqueripe Bay/Chag./ 4th May 1992." Cross was a Coast Guard Officer and environmentalist. Macqueripe Bay (~10.738056 -61.617222) is on the north coast of the Chaguaramas Peninsula and adjacent to Tucker Valley.

The area is now considered Chaguaramas National Park (CNP). The CNP is characterized by hills reaching a maximum height of 546 m a.s.l. at Morné Catherine. Tucker Valley is a mosaic of forests and farms, a golf course, a rifle and archery range, military installations, and private residencies. The area contains numerous seasonal streams, and the predominant vegetation is tropical dry forest (Beard, 1946) with patches of mixed primary and secondary, wet and dry forest, as well as agricultural land. Large stands of the invasive bamboo, *Bambusa vulgaris*, occur throughout the area. Emsley (1977:238) considered *Dipsas v trinitatis* one of the rarest snakes on the island, "...known only by a few specimens taken on shrubs..." However, one of us (JCM) collected more than 20 specimens in the last three decades. While we have not examined every museum specimen of *D. trinitatus* we have seen most of them. How *Dipsas variegata* avoided detection on a relatively well studied island is difficult to understand considering the work of Emsley (1977), Murphy (1997), and Boos (2001).

Cadle and Myers (2003) discussed *Dipsas variegata* subspecies noting *D. v trinitatis* and *D. v variegata* have similar meristics and colour patterns and accepted

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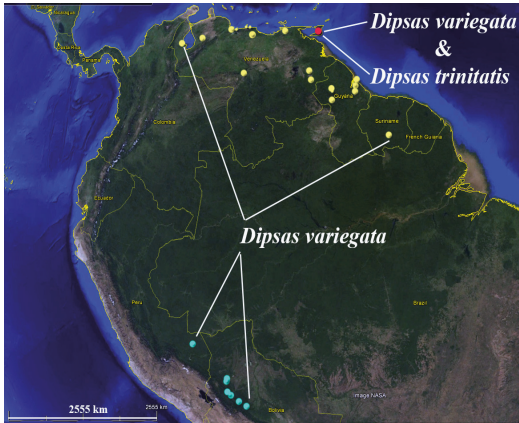


Figure 1. The distribution of *Dipsas variegata*. The colours mark different populations Venezuelan-Guiana (yellow), southwest Amazonia (blue). On Trinidad (red) both *Dipsas variegata* and *D. trinitatis* occur together. Localities shown are based on literature reports.

Peters' (1960) conclusion that the two are conspecific. They also observed *D. v. trinitatis* has a smaller head in relation to the body and fewer maxillary teeth (6–8) than does *D. v. variegata* (9–11). In that same paper Cadle and Myers removed *Dipsas v. nicholsi* from *D. variegata* as proposed by Peters (1960); and resolved the systematics of *Dipsas variegata* in Panama and western South America, demonstrating these populations were not *D. variegata*.

Subsequently, Harvey (2008) considered *Dipsas variegata* to include two disjunct populations (Figure

1), one on the Guiana Shield (the type locality for *D. variegata* is Suriname) and in Venezuela, and another in southwestern Amazonia (Bolivia and Peru). In the same paper, Harvey elevated *D. v. trinitatis* to species status citing the differences in maxillary teeth counts. In a follow-up, Harvey and Embert (2008) compared the morphometrics of *D. variegata*, including the northern South American population, the southwest Amazonia population, *D. trinitatis*, and specimens from Brazil, that are now recognized as *D. neivai*.

The southwest Amazonia sample size examined by Harvey and Embert (2008) was small, four specimens, but suggests males have more ventrals than females (Table 1), an unusual trait in snakes but one previously reported in *Dipsas* (Cadle, 2005). They also elaborated on the distinctiveness of *D. trinitatis*, citing fewer maxillary teeth, the complete lack of sublabials in *D. trinitatis*, the lower number of upper labials (usually 8) and the reduced number of lower labials (usually 11). Dorsal scale row counts in *D. variegata* are 15-15-15, Cadle and Myers (2003) report this scale count formula for both *D. variegata* and *D. trinitatis*. Despite the small sample size the southwest Amazonian population appears distinct from both the Guiana-Venezuelan population of *D. variegata* and *D. trinitatis* on the basis of ventral counts. However, northern South American *D. variegata* and *D. trinitatis* cannot be distinguished from each other using ventral or subcaudal counts.

We found the eye diameter of *D. trinitatis* is about twice the eye-mouth distance, while *D. variegata* has an eye diameter approximately equal to the eye-mouth distance. This is also reflected in the eye diameter/head length, see Table 1. The vertebral scale row in *D. variegata* is greatly enlarged, more than twice (2.6x) the

Table 1. A comparison of *Dipsas variegata* and *Dipsas trinitatis* populations. nd= no data.

	Southwest Amazonia (from literature)	Guiana & Venezuela (from literature)	Trinidad (this study)	Trinidad (this study)
	<i>D. variegata</i>	<i>D. variegata</i>	<i>D. variegata</i> (n=1)	<i>D. trinitatis</i> (n=12)
Dorsal scale rows	15-15-15	15-15-15	15-15-15	15-15-15
Ventrals Males	195–196 (x=188, n=2)	176–191 (x=180, n=5)	nd	172–186 (x=182.29, n=7)
Ventrals Females	185–191 (x=195.5, n=2)	172–182 (x=180, n=4)	174	175–184 (x=180.3, n=5)
Subcaudals Males	88–93 (x=90.5, n=2)	79–91 (x=89, n=2)	nd	90–95 (x=92.8, n=5)
Subcaudals Females	78–83 (x=80.5, n=2)	72–85 (x=81, n=5)	81	74–89 (x=82.6, n=6)
Eye diameter/head length	0.158–0.22 (x=18.8)	15.8–19.4 (x=0.171)	0.21	0.28–0.38 (x=0.31, n=7)

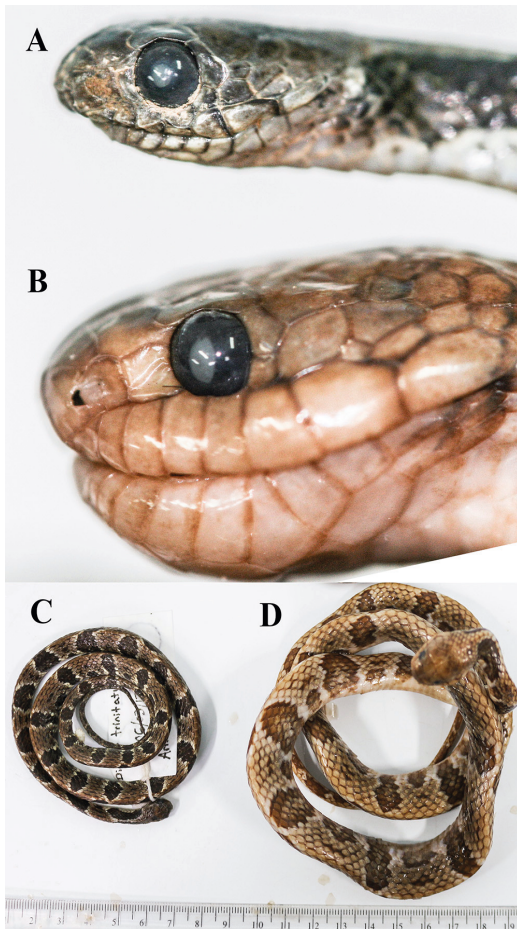


Figure 2. A. *Dipsas trinitatis* (UWIZM.2012.9.3), B. *Dipsas variegata* (SS92/8001.163) from Trinidad. The differences in head shapes, eye sizes, and body sizes are readily apparent. A comparison of whole specimens C. *Dipsas trinitatis*, D. *D. variegata* (left). Both specimens from Trinidad.

width of a nearby dorsal and obviously distinct from the other dorsal scales. The vertebral row in *D. trinitatis* is less obvious, but none the less slightly enlarged, about 1.5x the width of a nearby dorsal at mid-body.

Cadle and Myers (2003) noted the smaller head in *D. trinitatis* and it is somewhat apparent in their Figure 3. The size difference is more obvious in our Figure 2. It appears that *Dipsas variegata* is macrocephalic, while *D. trinitatis* is microcephalic. Measurements of head circumference divided by body circumference reveals *D. variegata* has a ratio of 1.06 ($r=0.95-1.17$, $sd=$

0.11, $n=2$), while *D. trinitatis* has a mean head to body circumference ratio of 0.73 ($r=0.53-0.84$, $sd=0.10$, $n=5$).

Microcephalism evolved in several sea snakes (*Hydrophis*, family Elapidae, Hydrophiinae) that specialize in hunting snake eels in crevices (Voris and Voris, 1983; Sanders *et al.* 2013). The smaller head allows the snake to probe holes and crevices to extract the fish. Since *Dipsas* feeds on snails and extracts them from their shells it seems probable that the difference in head size is adaptive for a specific type of prey, or a specific foraging strategy (possibly removing snail bodies from shells of different sizes or extracting snails from crevices). Because feeding behaviour and diet in these snakes is poorly known it is unclear as to how head size relates to diet or foraging. Thus, it is tempting to speculate *D. trinitatis* evolved a smaller head in response to living on the same island with *D. variegata* to avoid competing for the same species of snails. Lotzkat *et al.* (2008) reports *D. variegata* feeding close to, or on the forest floor at night. The holotype of *D. trinitatis* contained the radula of the snail *Plekocheilus glaber* (family Bulimulidae) (see Parker, 1926). On Trinidad, *Plekocheilus glaber* is a common, habitat generalist that reaches 44 mm (MGR, personal observation). Other literature discussing specific species of snails eaten by these snakes refer to snail species taken by captive specimens (Boos, 2001), records that may not reflect the actual diet of the species.

Most specimens of *D. trinitatis* we have collected have been in the foothills of the Northern Range, or in lowland situations elsewhere on the island. Roze (1966) stated Venezuelan *D. variegata* are found below 500 m, an observation not supported by Lotzkat *et al.* (2008), who report the species at medium elevations up to 1,300 m; this holds true for all of the Venezuelan localities we mapped (see Fig. 1). Guianan localities we mapped are at slightly lower elevations although MacCulloch & Lathrop (2004) report a specimen from 1,490 m on Mt. Ayanganna. The presence of both species on Trinidad raises the question of their possible co-occurrence in Venezuela, as previously suggested by Murphy (1997). Documentation of *Dipsas variegata* on Trinidad makes it the 44th snake species confirmed on the island.

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