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REDESCRIPTION OF *DITAXODON TAENIATUS* (HENSEL, 1868) (SERPENTES, COLUBRIDAE, XENODONTINAE): VARIATION, RELATIONSHIPS, AND DISTRIBUTION

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ABSTRACT: One of the rarest of the Neotropical snakes, *Ditaxodon taeniatus* (Hensel, 1868) is known from only 18 specimens (including the holotype which has been lost). In this paper, we redescribe the species, designate a neotype, and discuss variation in morphology and color patterns. Its distribution appears to be discontinuous: it has been recorded only from the Brazilian states of Rio Grande do Sul, Paraná, São Paulo and Mato Grosso do Sul. The little we know of the natural history of *Ditaxodon* indicates that it is grassland savanna dwelling, terrestrial, and oviparous. Its allocation to the xenodontine colubrid Tribe Philodryadini is supported.

KEY WORDS: *Ditaxodon taeniatus*, Serpentes, Colubridae, Xenodontinae, Brazil, taxonomy, natural history.

INTRODUCTION

Among the rarest of the South American colubrid snakes, *Ditaxodon taeniatus* (Hensel) is a striped racer-like species inhabiting the grassland savannas *(Campos Limpos)* of southern Brazil. Hensel (1868:331) described the species in the genus *Philodryas* Wagler. Boulenger (1896:124) transferred it to the genus *Conophis*, but Hoge (1958:54), examining microscopic ornamentation of the surfaces of the dorsal scales, recognized its distinctive characteristics and placed it in a new genus, *Ditaxodon.*

Other than these references, the report by Moura-Leite *et al.* (1996) of two new specimens, and a brief account of the species by Peters and Orejas-Miranda (1970), the species has been merely mentioned in lists of Neotropical snakes (Boulenger, 1886; Martins, 1916; Amaral, 1930a, b; 1936, 1937; Lema, 1958; 1987; 1994; Lema *et al.*, 1980). Amaral (1978) presented the only good illustration of the species; a plate drawn by Robert Kleyer. Morato (1995) discussed its distribution, and Bérnils (1994), Morato *et al.* (1995) and Bérnils *et al.* (2004) the conservation status of the species in the Brazilian state of Paraná. Frank and Ramus (1995) gave the species the common name "Hensel's snake", and Lema (1994) the Portuguese common names of "cobra-cipó marrom" and "cobra espada das árvores" (meaning brown liana snake and arboreal sword-snake, respectively).

We present here our findings from an examination of all known specimens of *D. taeniatus*, and summarize the information available on its natural history from notes accompanying the most recently collected specimens.

MATERIAL AND METHODS

Besides some observations based on field work, this paper is based on preserved material currently or formerly curated in the following museums: Museu de História Natural Capão da Imbuia (MHNCI), Curitiba; American Museum of Natural History (AMNH), New York; and Instituto Butantan (IBSP), São Paulo. Data published in Hoge (1958) were used for the holotype which was originally in the Zoologisches Museum am der Humboldt-Universität (ZMB), Berlin, but is now missing.

Data from 17 specimens were taken by the customary methods. All measurements were taken to the nearest millimeter with a meter stick, and ventral scales

were counted using the Dowling (1951a) method (the spine on the tip of the tail was included in the subcaudal counts). Dorsal scale row reductions follow Dowling (1951b), with their summations shown as suggested by Thomas (1976). If not obvious from external examination, the tails were slit for sexing and/or hemipenial examination. Abbreviations used in the descriptions are TL (total length) and sc (subcaudals).

Results and Discussion

Ditaxodon taeniatus (Hensel, 1868)

Philodryas taeniatus Hensel, 1868:331-332.
Conophis taeniatus (Hensel): Boulenger, 1896:124.
Ditaxodon taeniatus (Hensel): Hoge, 1958:54-55.

Holotype – ZMB 5980, an adult male from "Porto Alegre, Rio Grande do Sul, Brazil". The holotype is apparently lost, according to Günther Peters (Institut für Systematische Zoologie at the Museum für Naturkunde, Humboldt Universität, Berlin), pers. comm.

Designation of Neotype – The neotype is IBSP 10545 (Fig. 1), an adult male from Palmeira (25°20'S 50°00'W, 860 m), state of Paraná, Brazil. Measurements: 543 mm TL, tail 122 mm; tail/TL 0.225; usual colubrid complement of head scales; supralabials 7/7, III&IV/III&IV entering the eye; infralabials 9/9, 5/5 contacting both genials; loreals 1/1; temporals 1+3/1+3 (in both sides rising a small scale above the anterior temporal, probably a fragmentation of a corner of the parietal shield); preoculars 2/2; postoculars 2/2; ventrals 177; anal divided; subcaudals 77; dorsal scale rows 17-17-15 (reduction is by fusion of rows 3 and 4 on each side, over ventral 123 on the left and 126 on the right); hemipenis is 13 sc long; 14 prediastemal maxillary teeth with two grooved postdiastemal teeth; tooth morphology as described below under 'Variation'.

Figure 1: The neotype of *Ditaxodon taeniatus* (IBSP 10545), an adult male from Palmeira, Paraná, Brazil.

The following description of an *in situ* hemipenis in the neotype is quoted from the notes of Charles W. Myers (Division of Vertebrate Zoology, American Museum of Natural History, New York): "Right retracted organ extends to end of sc 14, being slightly bilobed from the base of the same (14th) sc. The branches of the major retractor merge at level of sc 16 and the muscle originates at about sc 36. Organ then opened on midventral side, removed and pinned flat for description and illustration. The s.s. [author's note: *sulcus spermaticus*] bifurcates shortly above the basal 1/3 of the hemipenis and its branches extend along the lateral wall to the tips of the small lobes. The s.s. branches are apparently centrolineal (the branch in the dorsal lobe seems to lie low on lateral wall and does not swing high towards dorsal side – judged by prying into lobe). The organ is unicapitate, with capitation moderately developed on the asulcate side and with the small lobes comprising about the distal 11% of the organ and being covered with confluent calyces. The calyces are papillate and especially large and deep on the asulcate side of the capitulum; on the sulcate side, a narrow zone of calyces and lg. papillae extend basal along the outside of the *sulcus* fork – on the top 1/3 of the organ [like the calyces on the head, these are densely packed and do not spread out readily; in the drawing, this area on the left edge of the organ belongs to the right side of the fork and is considerably spread relative to the area on the left side of the fork]. There are dozens of small to medium-sized spines, the largest comprising several vague vertical rows on asulcate side of organ. There are no truly large spines and no basal pocket (at least not pronounced). There are some spinules on the otherwise nude base."

In preservative, the dorsum consists of shades of brown; the vertebral stripe is 4 dorsal scale rows wide (the central 3 and one half of the adjacent scales on each side), and a rich brown color; along its margin is a pale stripe consisting of light stripes down the middles of the scales in rows 7 on each side; the dark vertebral stripe is bordered on each side by a lighter brown dorsolateral stripe situated on row 5 (upper half),

all of 6, and the lower half of 7; the margins of this dorsolateral stripes (lower half on row 5 and upper half on row 7) form darker brown lines; a dark brown lateral stripe (identical in color and shade to the vertebral stripe) extends from the outer margins of the ventral scales, then covers scale rows 1-4 and the lower half of 5 on each side; pale dashes at the outer margins of the ventrals form a light stripe running the length of the body. The venter is immaculate pale inside the dark lateral margins. Top of head with no obvious pattern (very dark overall), but with supracephalic plates painted with faint, ill-defined darker and lighter areas; a pale thin postocular stripe running along the tops of the supralabials on each side; the ventral surface of the lower jaw heavily suffused with dark pigment, darker down the center and laterally (dark pigment disappears at the first ventrals); light elongated spots adorn chin shields and both the supralabials and infralabials.

The specimen is well preserved, but most of the epidermal scales have slipped; the tail is broken (but still intact), and was cut for sexing.

Variation – Largest male 707 mm TL, tail 163 mm (IBSP 40751); largest female 864 mm TL, tail 170 mm (IBSP 1428); tail/TL 0.232-0.244 (n = 6, μ = 0.232, SD = 0.007) in males, 0.175-0.197 (n = 7, μ = 0.187, SD = 0.007) in females; usual colubrid complement of head scales present; supralabials 7(33 sides) or 8 (1), III&IV (33) or IV&V (1) entering orbit; infralabials 8 (1) or 9 (29); 5 (32) infralabials contacting both genials on each side; loreal 1 (34); preoculars 1 (32) or 2 (2); postoculars 1 (1) or 2 (33); temporals 1+2 (32) or 1+3 (2); ventrals 165-178 (n = 6, μ = 173.17, SD = 4.52) in males, 186-199 (n = 10, μ = 189.0, SD = 3.63) in females; anal plate divided (17); subcaudals in two rows, 66-80 (n = 6, μ = 75.17, SD = 4.49) in males, 59-69 (n = 9, μ = 65.33, SD = 3.50) in females; dorsal scales smooth without apical pits; abbreviated dorsal scale row formulae 17-17-13 (1) or 17-17-15 (16), with the following summation for complete formulae (after Thomas, 1976):

[1] 4+5	μ = 128.15
[12] 3+4 (119-141)	μ = 184.23
17(1)	15 (165-199)
[10] 3+4 (123-141)	
[2] 4+5	μ = 129.15
[1] 2+3	

Figure 2: Dentary of *Ditaxodon taeniatus* (IBSP 3672), showing the diastema.

Opisthoglyphous prediastemal maxillary teeth 13 (2 sides), 14 (6), 15 (5), or 16 (1), followed by two grooved postdiastemal teeth. In the prediastemal series, all are subequal except the last tooth, which is twice the length of the others in the series; the postdiastemal tooth is again twice as large as the ultimate tooth in the prediastemal series. The dentaries have a diastema (Fig. 2), with 7 (2 sides) teeth to the anterior of the diastema and 9 (1 side) or 10 (1) posterior; palatine teeth 13 (1 side) or 15 (1); pterygoid teeth 18 (1 side) or 21 (1).

Zaher (1999:58) presented a thorough description (p. 58) and photos (lower two of his fig. 42, including sulcate and asulcate views) of the hemipenis of *D. taeniatus* (IBSP 40751). The following brief hemipenial description is based on *in situ* organs of IBSP 10421, 10545, and 40751: organ slightly bilobed and differentiated, having papillate calyces that extend to mid-length on the sulcate surface; on the asulcate surface, calyces very enlarged and paired (similar to those in *Philodryas*, *Xenoxybelis*, and *Pseudablabes*); retracted length to middle of sc 11 to rear of sc 13, bilobed for about one half sc; *m. retractor penis magnus* divided for about 1 sc and originates between sc 33-35; *sulcus spermaticus* divides at middle of sc 4-6. Zaher (1999) noted the "unique row of enlarged lateral spines" on the lateral margins of the asulcate surface. Marginal spines are seen in most *Philodryas* (see Zaher [1999], fig. 65 of *P. aestiva*) and other genera, but *Ditaxodon* has fewer spines overall, with the above mentioned enlarged spines being predominant.

Ditaxodon taeniatus is a striped snake of various shades of brown and cream (gray and black in preservative). The head has a well-defined snout and *canthus rostralis*. The top of the head is light brown (dark and reticulated in preservative), with the loreal surface being a darker brown. There are pale stripes on the prenasal and first three supralabials; and also a postocular pale stripe along the upper margins of the last four supralabials. The eye is quite large (its diam-

eter one half the snout-length), the pupil is round, and the iris is brown. The body is striped (see Fig**.** 3), a brown base with dorsolateral pale (cream to tan) stripes that are three scale rows wide (outer two normally have dark pigmentation on their margins shared with adjacent darker stripes). The mid-dorsal stripe is three scale rows wide, and is generally the same shade of brown as the lateral stripes of the lower four scale rows on each side. The lower two scale rows usually have pale stripes down the center of each scale. Tail striped to the tip. Venter is yellow in live specimens (white to cream in preservation), varying from immaculate to variously suffused with dark pigment (Fig**.** 4).

Distribution – The geographic range of *Ditaxodon taeniatus* includes four Brazilian states (Paraná, São Paulo, Rio Grande do Sul, and Mato Grosso do Sul), but is centers on Paraná (Fig**.** 5). We believe that the original type locality, "Porto Alegre", is dubious. It is the only record at sea level – all others are in the highlands, between 800 and 1000 m in the state of Paraná and about 1800 m in the state of São Paulo. The species is distributed between 21°S and 30°S, indicating a distribution characterized by open formations, particularly *"Savana Estépica Gramíneo-Lenhosa"* (Brasil, 1992), commonly referred to as *Campos Limpos.* According to Maack (1950; 1981), Hueck (1972), and Hueck and Seibert (1972), *Campos Limpos* are characterized as savanna dominated by short grasses, but with *"capões"* (islands of *Araucaria* forest situated in wet orographic depressions) and strips of semi-deciduous gallery forest along the margins of rivers and creeks.

Ditaxodon taeniatus has been recorded from northeastern São Paulo, from the highlands of inland Paraná,

Figure 3: *Ditaxodon taeniatus* (MHNCI 5827) alive. Photo by Magno V. Segalla.

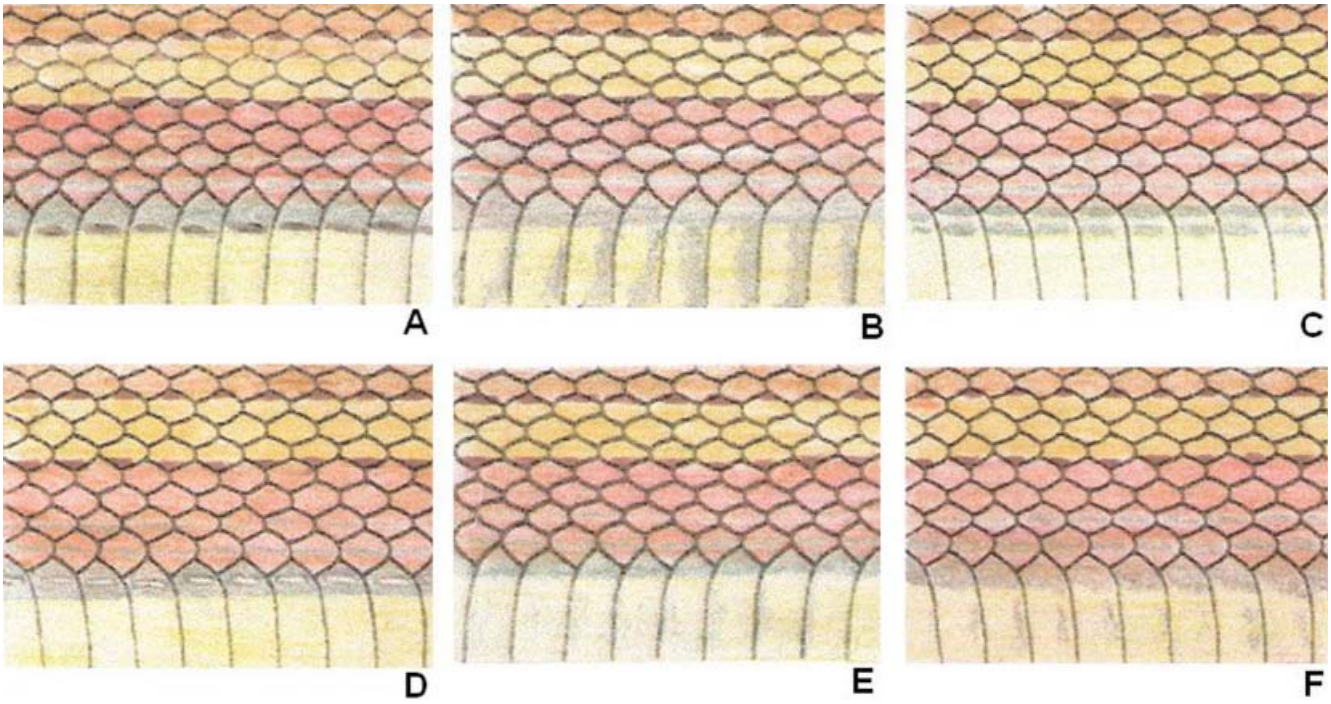

Figure 4: Lateroventral pattern variation in *Ditaxodon taeniatus.* A, IBSP 10421, Palmeira, Paraná, male; B, IBSP 3672, Rio Grande do Sul, female; C, IBSP 20990, Ponta Porã, Mato Grosso do Sul, male; D, IBSP 9964, Emílio Ribas, São Paulo, male; E, MHNCI 5827, Vila Velha, Paraná, female; and F, MHNCI 5924, Vila Velha, Paraná, female.

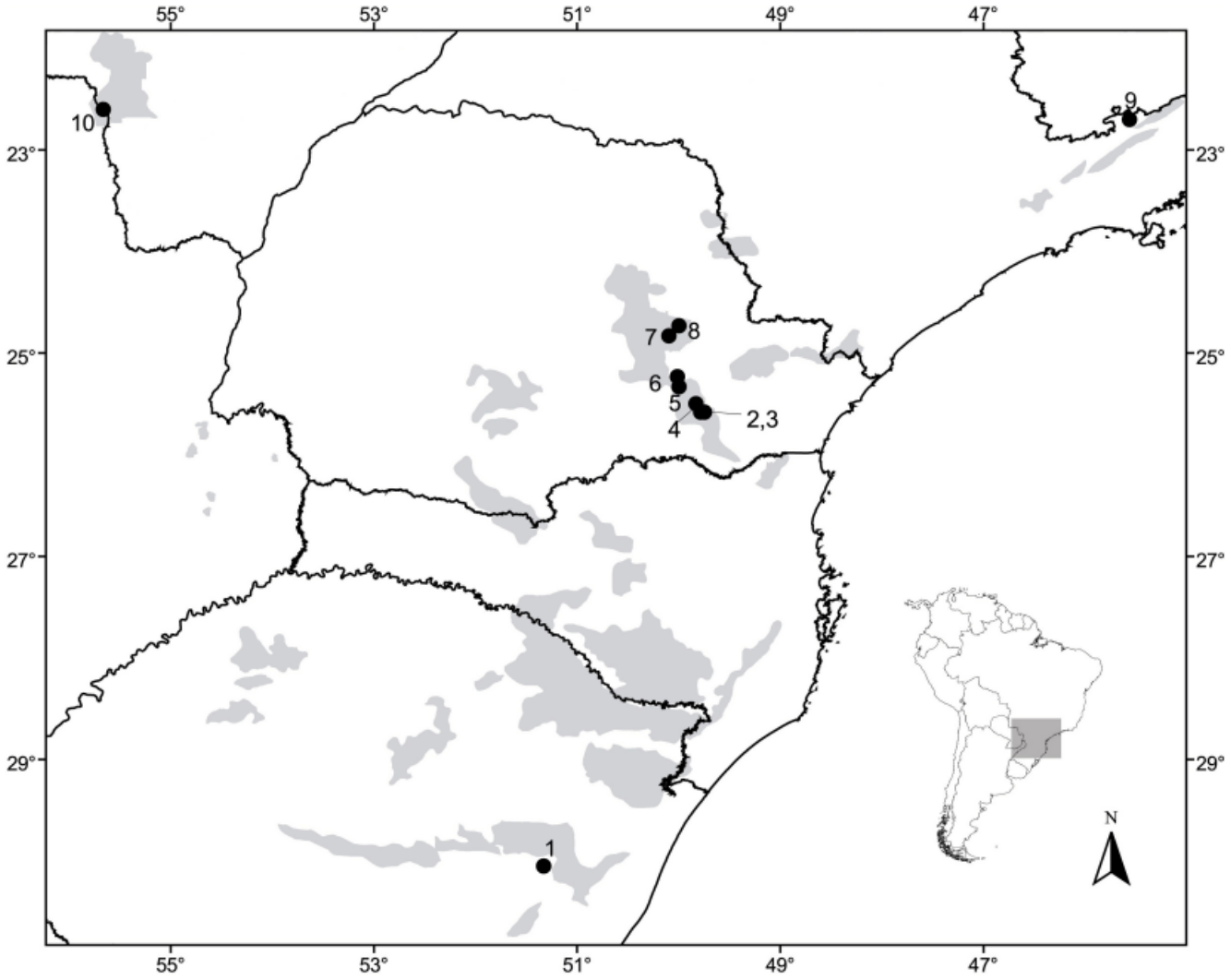

Figure 5: Distribution of *Ditaxodon taeniatus*. 1, Porto Alegre (original type locality); 2, Fazenda Santa Maria; 3, Tamanduá; 4, Caiacanga; 5, Palmeira (new type locality); 6, Vila Velha; 7, Boqueirão; 8, Castro; 9, Emílio Ribas; 10, Ponta Porã. Grey areas represent meridional grassland formations *(Campos Limpos)*, according Hueck and Seibert (1972), and Brasil (1992).

and from Rio Grande do Sul. A single record from southeastern Mato Grosso do Sul is doubtful. Its range is evidently disjunct at least between the southern populations and those in northeastern São Paulo. This would be appear to be associated with the distribution of open formations related to *Araucaria* forests in the Brazilian Southern Plateau and the slopes of the Serra da Mantiqueira (Hueck, 1972), and conforms with a distributional pattern shown by a number of other snake species, such as *Taeniophallus bilineatus* (see Di-Bernardo and Lema, 1990), *Phalotris reticulatus* (see Ferrarezzi *et al.*, 2004), *Pseudoboa serrana* versus *Pseudoboa haasi* (see Morato *et al.*, 1996), *Clelia montana* versus *Clelia rustica* and *Clelia hussami* (see Morato *et al.*, 2003), *Ptychophis flavovirgatus* (see Lema and Deiques, 1992), *Bothrops neuwiedi* (see Fernandes and Abe, 1991; Silva, 2000) and *Bothrops cotiara* versus *Bothrops fonsecai* (see Hoge and Belluomini, 1964). The absence of records of *Ditaxodon taeniatus* from the area of the megalopolis of São Paulo, one of the most heavily collected regions of South America, corroborates this hypothesis of disjunction.

The only record from western Brazil (Ponta Porã, Mato Grosso do Sul) and the type locality (Porto Alegre, Rio Grande do Sul) deserve special attention. The first is far from the rest of the known range of the species. Despite the distance, its occurrence in that region is probable, since there are *Campos Limpos* in the southwestern portion of Mato Grosso do Sul (Brasil, 1992). On the other hand, the type locality shows vegetational and altitudinal discrepancies with respect to the Bra-

zilian Southern Plateau of Paraná, where 78% of the known specimens have been recorded. Lema *et al.* (1980; 1985) have failed to find *Ditaxodon* in the region of Porto Alegre despite years of fieldwork. Its occurrence in Rio Grande do Sul is considered more probable than in western Brazil (Mato Grosso do Sul), because of a second specimen from the state (IBSP 3672), which, however, unfortunately lacks a precise locality. From what we know of *Ditaxodon* in Paraná, the vegetation formations in the northern part of the Rio Grande do Sul would be propitious for its occurrence there.

On examination of the specimens in the Instituto Butantan (IBSP), we found some erroneous or incomplete locality data. These we corrected as follows: Tamanduá, Paraná (= Tamanduá, municipality of Balsa Nova, Paraná); Boqueirão, São Paulo and Boqueirão, Paraná (= Boqueirão railway station, municipality of Ponta Grossa, Paraná); Palmeiras, Paraná and Palmeiras, Santa Catarina (= municipality of Palmeira, Paraná); and Caracanga, Santa Catarina (= Caiacanga railway station, municipality of Porto Amazonas, Paraná).

Notes on Natural History – Known only from 18 specimens, *Ditaxodon taeniatus* is rare. It is not "common in the south" as noted by Amaral (1936; 1937). An adult female (MHNCI 5827) was collected by Fabíola Iung on 20 October 1992, at 15:00 h, as it moved along on the ground in an area of savanna in Vila Velha State Park, Ponta Grossa, Paraná. The snake was docile when collected, and remained so. It was kept in captivity for a month, during which time it stayed on the ground, avoiding branches placed in the cage. This indicates terrestrial rather than arboreal preferences (as indicated by Amaral, 1978). When this specimen was preserved (November, 1992), it was found to contained ovarian follicles (largest were 3.6 mm).

Another female specimen (MHNCI 5924) was found dead on the road, also in Vila Velha State Park, on 5 December 1992. It contained 10 eggs in the right oviduct (one in atresia). The eggs were oblong, with lengths of 15-25 mm and a mean diameter of 4.5 mm. Amaral (1978) reported that *Ditaxodon* feeds on lizards and small birds. None of the specimens we examined contained food. All known specimens are adults, and were collected in the following months: January (1), February (1), March (2), April (2), May (3), October (2), November (1), and December (4). The striped pattern with pale brown coloration, found also in sympatric members of the *Liophis lineatus* Group and species of *Psomophis,* is presumed to be cryptic in the preferred grassland habitats.

Relationships – *Ditaxodon* remains an enigmatic taxon. It is often ignored due to the paucity of information on its anatomy, distribution and natural history (Underwood, 1967). Dowling and Duellman (1978) list *Ditaxodon* as belonging to the Tribe Alsophiini, Subfamily Xenodontinae, Family Colubridae, but with a question mark. In his ongoing work on the classification of snakes, Dowling placed the genus in Xenodontidae *incertae sedis* (1986) and as a philodryadine xenodontid with a question mark (1988). Jenner (1981) did not assign the genus due to insufficient information. Ferrarezzi (1994) redefined the Tribe Philodryadini (*sensu* Jenner, 1983) as including *Ditaxodon, Philodryas* (including *Platyinion*) and *Pseudablabes.*

Boulenger (1896) speculated that *D. taeniatus* was conspecific with, or at least closely allied to, *Conophis.* Hoge (1958), however, showed that they differ on the basis of the microornamentation of the dorsal scales. Zaher (1999: figs. 40, 41) showed that *Conophis* hemipenes have spinulate ornamentation whereas those of *Ditaxondon* have papillate ornamentation – the former has flounces on the asulcate surfaces (especially notable in *C. vittatus;* see his fig. 41).

Overall, the external morphological features and hemipenial structure (as discussed above) suggest that *Ditaxodon*'s affinities lie with genera related to *Philodryas,* but the diastema on the dentaries is unique among South American xenodontines. In the absence of molecular data, we agree with the assignment of *Ditaxodon* to Ferrarezzi's (1994) xenodontine colubrid Tribe Philodryadini, but do not support the association of all genera placed in that taxon by Dowling (1986).

Resumo

O raro colubrídeo neotropical *Ditaxodon taeniatus* (Hensel, 1868), conhecido apenas a partir de 18 exemplares, incluindo o holótipo (desaparecido), é redescrito, levando-se em consideração as variações encontradas, e um neótipo é designado. A distribuição geográfica de *D. taeniatus* é aparentemente descontínua, contando com registros para os estados

brasileiros de Rio Grande do Sul, Paraná, São Paulo e Mato Grosso do Sul. Os dados disponíveis sobre sua história natural indicam ser esta uma espécie campícola, terrestre e ovípara. A alocação de *Ditaxodon* em Philodryadini é sustentada e mantida.

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Appendix

Specimens Examined

BRAZIL: Mato Grosso do Sul: Ponta Porã, 22°36'S 55°40'W, 655 m (IBSP 20990). São Paulo: Campos do Jordão, Emílio Ribas, 22°42'S 45°34'W, 1700 m (IBSP 9964). Paraná: Balsa Nova, Tamanduá, 25°35' S 49°45'W, ca. 900 m (IBSP 6622); Castro, 24°44'S 50°00'W, 980 m (IBSP 720); Lapa, Fazenda Santa Maria, 25°35'S 49° 47'W, ca. 900 m (MHNCI 10019); Palmeira, 25°20'S 50°00'W, 860 m (IBSP 1428, 10421, 10545 [neotype], 40751, 42421; AMNH 117719 [formerly IBSP 10524]); Ponta Grossa, Boqueirão, 24°50'S 50°06'W, ca. 1000 m (IBSP 10542); Ponta Grossa, Vila Velha, 25°14'S 50°01'W, ca. 900 m (IBSP 31187; MHNCI 5827, 5924); Porto Amazonas, Caiacanga, 25°30'S 49°50'W, 810 m (IBSP 10540). Rio Grande do Sul: Locality unknown (IBSP 3672).