Prodichotomy in the snake *Oreocryptophis porhyraceus coxi* (Schulz & Helfenberger, 1998) (Serpentes: Colubridae)

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ABSTRACT - The first occurrence of prodichotomy in the colubrid snake genus *Oreocryptophis* is reported herein. A stillborn *Oreocryptophis porhyraceus coxi* specimen with two heads, necks and short parts of the trunk bears kyphoscoliotic malformations and small pattern aberrations. The difference in vertebral number between the left and the right side is 22%, and so far this is the highest recorded disparity in any snake. The maximum bifurcation percentage is 15% in SVL and vertebrae number, while it is only 10% in ventrals. The prodichotomic specimen is smaller than its normal siblings; the difference is 35% in SVL and 24% in weight. Pattern variability in the duplicated parts is discussed; and it is presently unclear whether this is of genetic or epigenetic origin.

PRODICHOTOMY is a case of somatodichotomy, when the head and anterior part of the body are duplicated to at least some extent, although they are not necessarily completely separated (Smith & Pérez-Higerada, 1987). According to Wallach (2007), no clear dividing line exists between prodichotomy and another somatodichotomy category recognized by Smith & Pérez-Higerada (1987), proarchodichotomy, where there is more than a half of the body anterior to the anus duplicated. There were 680 definite cases of various types of somatic duplication in snakes reported by 2006. Prodichotomy, with a prevalence of 61.4%, was the most common type (Wallach, 2007). Most cases were recorded in the family Colubridae, possibly because it is the largest snake family and also partly due to its popularity with snake breeders.

Herein I report the first case of prodichotomy and somatodichotomy in a colubrid snake *Oreocryptophis porphyraceus coxi* (Schulz & Helfenberger, 1998), which also represents the first record in the species *Oreocryptophis porphyraceus* (Cantor, 1839) and in the genus *Oreocryptophis* (Utiger, Schätti & Helfenberger, 2005). A freshly dead prodichotomic female snake was found in an egg from a clutch of 4 eggs laid by a F2 captive-bred female (Fig. 1). Three females without visible malformations successfully hatched from the remaining eggs. One of the females had a reduced striped pattern on the anterior part of the body. This pattern abnormality is described elsewhere (Jandzik, 2009). The pattern of the two remaining specimens corresponded with the subspecies diagnosis of Schulz & Helfenberger (1998).

The parent snakes were ca. 2 years old when bred. They were descendants of snakes originating from the type locality in province Loei, Thailand (K.-D. Schulz, pers. comm.). At the time of breeding, they measured 85 cm, showed no visible deformations and were considered healthy. They were kept under standard terrarium conditions described by Schulz (2000) and the breeding concerned was their first reproduction. Later the same year, the female laid a clutch of infertile eggs. Next year, this repeated twice, and thereafter the adult female died. The eggs were incubated in the dark on wet vermiculite at stable temperatures of 27-28ºC. The incubation period was 54 to 56 days. No chemical cleaners were used in housing or in the incubator. The eggs of seven other colubrid species, *Lampropeltis getula*, *Lampropeltis triangulum*, *Natrix tessellata*, *Pantherophis guttatus*, *Pantherophis obsoletus*, *Rhynchophis boulengeri* and *Zamenis situla*, were incubated under the same conditions and no malformed specimens occurred in any of these clutches.

The anterior part of the body of the prodichotomic specimen is duplicated in the horizontal plane (i. e., there is a left and a right head with a neck and a short part of the body). The right side measured 26 mm from the rostrum to the bifurcation, while the

left side at 20 mm was shorter. Just posterior was a 15 mm long transition zone, where both parts were externally fused, while the vertebral columns were separated. The length of the body posterior to the bifurcation (including the transition zone) was 146 mm and the tail length was 37 mm. The left side thus represented 77% of the right side length and the duplicated parts of the body represent 12 and 15% of the SVL (snout-vent length), respectively. Although both heads were normally developed without visible deformities, the left head was 12 mm in length, and smaller than the right one, which was 14 mm. An axial kyphoscoliotic malformation was present 15 mm posterior to the bifurcation. This had a prominent dorsal convexity almost at right angles to the right oriented horizontal scoliotic deformity (dextroscoliosis), which is of only moderate extent. Another, smaller and almost entirely horizontal dextroscoliosis occurred on the left side at the bifurcation level. Due to this deformity, the right side was more in line with the body axis than the left. Beside these scoliotic deformations, other small defects were present on the posterior half of the body along the vertebral line. These were in the form of scale malformations with underlying small fibrous and muscular bumps that were joined by striped pattern irregularities (Fig. 1). There was 19 dorsal scales around the mid-body, 21 ventrals (including the pre-ventrals) on the right side and 18 on the left anterior to the bifurcation. The trunk was covered with 183 ventrals posterior to the bifurcation, while the lower side of the tail had 63 subcaudals. These scale counts are in accordance with those typical for the subspecies *O. p. coxi* (200 to 213 ventrals, 62 to 72 subcaudals) reported by Schulz & Helfenberger (1998). The bifurcation in ventrals is 10 and 9%, respectively, which is lower than in SVL. There were a few incomplete ventrals inserted on both duplicated sides. The ventrals, occurring in the region of kyphoscoliotic deformations, were not completely developed and some were fused together. Also 20 subcaudal pairs, almost one third of their entire number, were fused together. Apparent on the radiograph were 27 vertebrae on the right side and 21 on the left side anterior to the bifurcation. The difference in vertebral number between each side is therefore 22%. This is 2% higher than the highest previously recorded difference in any snake, according to the most recent and comprehensive review of Wallach

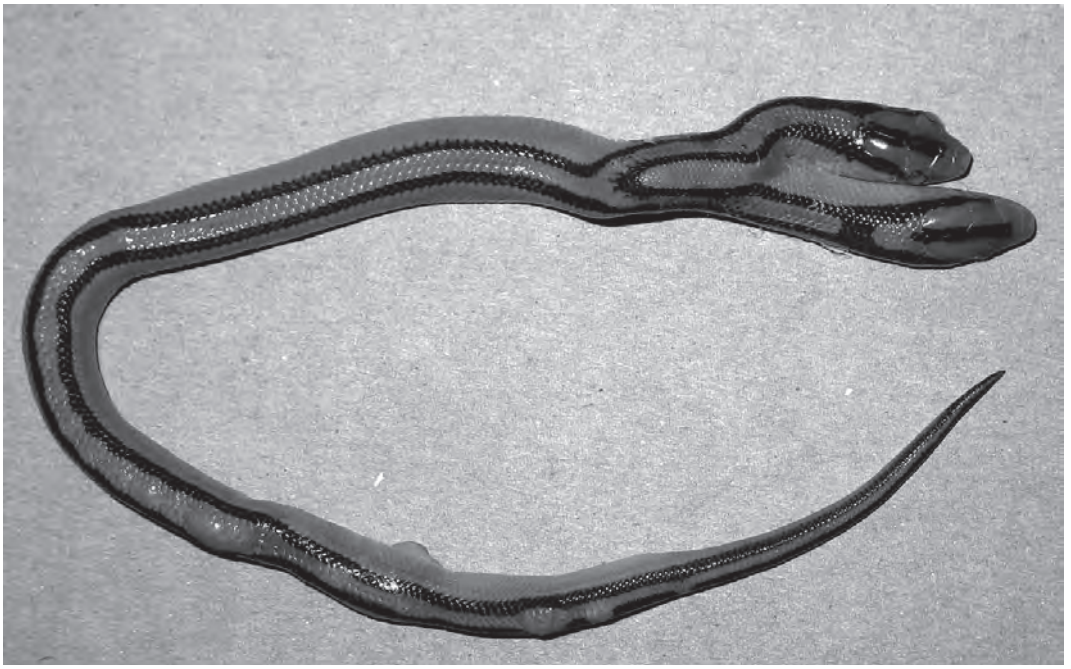

Figure 1. The dorsal view of the prodichotomic *Oreocryptophis porhyraceus coxi* specimen.

(2007). The fusion zone comprised 7 vertebrae and there was about 145 trunk vertebrae posterior to the fusion zone (± 15; the posterior trunk vertebrae were not completely distinguishable on the radiograph). The total body vertebrae number was thus ca. 179 on the right side and about 173 on the left, respectively. The bifurcation expressed in vertebral number is therefore ca. 15% and 12%, respectively. This is the same as the bifurcation percentage in SVL, but differs from the lower bifurcation percentage in ventrals.

This malformed *O. p. coxi* specimen was considerably smaller than its siblings. The difference in SVL (mean SVL of 3 siblings = 265 mm) was 35% on the right side and 37% on the left, while the difference in the tail length was only 24% (mean tail length of 3 female siblings = 49 mm). In total length (SVL + tail length), the difference forms 33% on the right side and 35% on the left side (mean total length of 3 siblings = 314 mm). However, weight difference was less prominent. The weight of the prodichotomic specimen was 6.6 g before preservation, whereas the mean weight of its siblings was 8.7 g, and therefore the difference is 24%. This is in contrast to the general trend in snakes, where normal specimens usually differ more in weight than in length, when compared to their hatchling twin siblings (Wallach, 2007). A weight comparison of prodichotomic snakes with their normal siblings has not yet been published (Wallach, pers. comm.), and therefore no comparison with other snakes is possible.

The pattern of the prodichotomic specimen is exhibited clearly on Fig. 1. It is important to notice the difference between the neck patterns. The right neck bears a dark blotch, while this is absent on the left neck. According to the subspecies diagnosis, the dark blotches are either present or absent on the anterior part of the body (Schulz & Helfenberger, 1998), thus both pattern forms could be considered 'normal'. This pattern difference may represent a case of phenotypic plasticity, where two different variants from the same genotype are expressed under different conditions. However, whether this was the proximate cause of variable pattern expression in the specimen remains unclear because partial fusion of two embryos is also a developmental mechanism believed to cause prodichotomy (Wallach, 2007). Both anterior parts may possibly represent genetically different specimens. In this case, the different patterns would then only be a result of different genotypes expression. Further genetical investigation would be needed to test these hypotheses and answer such complex questions about prodichotomy in snakes.

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