Polyphalangy incidence in an isolated population of *Pleurodeles waltl* founded in a rural well in the Southwest of Spain

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Resumen: En este artículo se describen las malformaciones observadas en las extremidades de tres gallipatos (*Pleurodesl waltl*) pertenecientes a una misma población que se localizó aislada en un pozo de la campiña sur de Cádiz (España). Los tres ejemplares, dos adultos machos y una larva de gran tamaño, presentaron polifalangia en uno o dos dedos, según el caso.

Within agricultural landscapes in rural Spain, especially in the east and south, farmers tend to throw sharp-ribbed newts (*Pleurodeles waltl* Michaelles, 1830) into wells, since they believe that these amphibians help to maintain water clean (Barbadillo *et al.*, 1999). In this man-made aquatic habitat, newts can live for years in isolation, feeding themselves on prey that accidentally fall into the well. Moreover, some wells may even support newt populations with breeding success (authors, unpublished data).

During the summer of 2016 we found a rural well in Vejer de la Frontera (Cádiz, southern Spain; UTM coordinates X: 233522; Y: 4018081; 14 masl), and it was sampled for the presence of *P. waltl* on 20 August 2016. The well is circular in shape, with a diameter of 3.45 m, and a depth of 6.1 m. At the time of data collection, the water table of the aquifer was found at 5.5 m below ground level, the water conductivity was 1187 $\mu S \cdot cm^{-1}$, and the pH was 7. The parapet of the well, 50 cm high, prevents the accidental fall of newts into the well (Figure 1). The landscape around the well is dominated by extensive cultivation of sunflowers and pasture for livestock, so the

Figure 1: Image of the well during sampling.
Figura 1: Vista exterior del pozo durante el muestreo.

groundwater is mainly used by animals for drinking, and not for irrigation.

During sampling, 18 individuals of *P. waltl* were collected (four adults, two metamorphic, and 12 larvae) using a dip net (2826 cm^2, with a mesh width of 4 mm). Out of a total number of 18 individuals, three of them had limb abnormalities (16.7% of the population). Specifically, we describe herein the presence of extra bones in one or two digits, which is described in the literature as polyphalangy (Meteyer, 2000).

The first specimen, an adult male with a total length of 155 mm, presented polyphalangy in its third digit of the left forelimb, and also polyphalangy in its fourth digit of the right rear limb (Figure 2). The second newt, an adult male with a total length of 160 mm, presented polyphalangy distally in its third digit of the left hind limb (Figure 3). Finally, the third animal was a larva in stage V according to Braña (1980), and had polyphalangy in its fourth digit of the left hind limb (Figure 4). All of the newts were carefully returned to the original well after measuring them and photographing the abnormalities.

Although different types of skeletal abnormalities have been reported in Iberian urodeles, such as *Chioglossa Lusitanica* (Sequeira *et al.*, 1999), *Triturus marmoratus* (Diego-Rasilla, 2000; Diego-Rasilla *et al.*, 2007), *Salamandra salamandra* (Escoriza & García-Cardenete, 2005; Villanueva, 2007), and *Lissotriton helveticus* (Diego-Rasilla, 2009), to our knowledge, this is the first documented case of limb abnormalities in *Pleurodeles waltl*. The available information does not allow us to determine possible causes for the observed polyphalangy, so we hypothesize that spontaneous regeneration following trauma could be one of the factors causing these abnormalities, together with associated infectious disease, as described by Johnson *et al.* (2006).

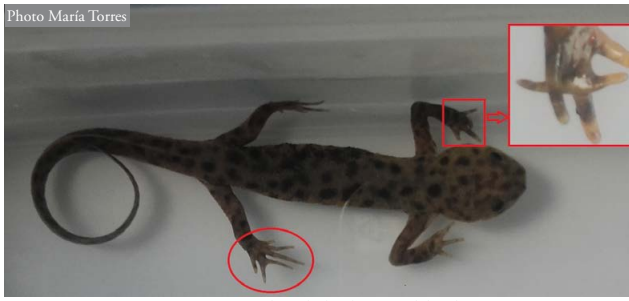

Figure 2: First specimen, male adult sharp-ribbed newt, and limb deformities.
Figura 2: Imagen del primer individuo, un gallipato macho adulto con deformidades en dos extremidades.

Cannibalism has been observed in *P. waltl* (Hodar *et al.*, 1993; Barbadillo *et al.*, 1999; authors, unpublished data). As the rural well is a confined habitat, the food is scarce, plus during the summer months the water table of the unconfined aquifer decreases due to water extraction and the lack of rain. Those facts create a higher stress on the population, increasing physical contact and attacks within them, leading to higher a incidence of finger amputation. This could explain the higher percentage of limb abnormalities observed in this particular well, which exceeds by far the estimated background deformity frequency of 0–5% predicted in

Figure 3: Second specimen, male adult sharp-ribbed newt, and limb deformity.
Figura 3: Segundo individuo, macho adulto con deformidad en la extremidad posterior izquierda.

Figure 4: Third specimen, larval sharp-ribbed newt, and limb deformity.
Figura 4: Tercer espécimen, larva de gallipato y deformidad en su extremidad posterior izquierda.

amphibians (Piha *et al.*, 2006). However, other possible factors should be considered, such as fertilizers, chemical pesticides or any other agricultural contaminants, or the synergic interaction among all these factors. In our opinion, future studies are needed to fully understand the causes leading to these abnormalities.

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