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Chapter 16

Captive breeding of *Podarcis filfolensis*

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Introduction

The Maltese wall lizard, *Podarcis filfolensis* (Bedriaga), is a species endemic to the Maltese archipelago and the islands of Lampedusa, Linosa and (probably) Pantelleria. Owing to the very small size of its distribution area, its reproduction biology has hitherto received little attention. Today we therefore lack basic information on the number and size of the eggs and the length of their development, and on the size of the young at hatching, etc. (see Bischoff, 1986). The aim of this brief report is to supplement our knowledge in this direction by some concrete data on the reproduction of *P. filfolensis* obtained in captivity.

Material and Methods

Two pairs of *P. filfolensis* were kept under captive conditions for five years to observe their breeding. The animals belonged to the following subspecies:

1. *P. filfolensis maltensis* (PFM) ; the male from the island of Malta (L= 60mm), the female from the island of Gozo (L= 58mm).
2. *P. filfolensis kieselbachi* (PFK) ; from the island of San Paul (the male: L= 61mm, the female: L= 59mm; measured in January 1992).

When caught in 1986, the animals were already adult. The pairs were kept separately in terraria with a natural lay-out, measuring 800 x 400 x 300 mm. Every year, in January and February, the lizards were hibernated at about 10°C. Dishes with a layer (100 mm) of damp substrate (shredded *Sphagnum* and fine sand) were placed in the terraria for the lizards to lay their eggs.

Results and Discussion

Under natural conditions, definitely on the island of San Paul, where the lizard (*PFK*) population is very dense, we observed, in August 1986, marked territorial behaviour of the males, which fought and pursued one another. In the terrarium also, the lizards (the females of both subspecies, as well as the males) were similarly aggressive towards each other. They pursued and bit each other, so that the females, in particular, had often injured or missing toes. Mutual intolerance was likewise observed among the young from approximately the age of three months: in them, mutual pursuit and biting also led to the loss of toes and in one case to the animal's death.

Even after five years in captivity the lizards were still shy, which made it difficult to observe their courting behaviour. A few jaw marks on the female's neck may be evidence that the males, before or during pairing, seize the skin in the region of female's neck in their jaws (see also Lambert, 1969). Bischoff (1986) described the presence of jaw marks on the female's flanks in preserved museum specimens.

The number of clutches per year, the number of eggs in a clutch and the incubation period of the eggs of *P. filfolensis* are given in Table 1. The eggs were always laid directly on the floor of the dish, in a little cavity scratched out for them in the substrate by the female. *Podarcis muralis* was found to deposit its eggs in a similar manner (see Gruschwitz and Böhme, 1986). Altogether, we found that *P. filfolensis* laid only one or two clutches of eggs a year, with an interval of 25-41 days between them. In one case we saw one female (*PFK*) lay a single egg and devour it a few hours later. In small island lizard populations characterized by high density (as is the case with *PFK*), devouring the eggs could, under natural conditions, be a normal phenomenon associated with the limited sources of food on small, rocky islands. In this connection, Mertens (1926) drew attention to the possibility of cannibalism in *P. filfolensis* and remarks made by Lanfranco (1955) likewise imply that their own young probably form part of the diet of these lizards.

Table 1. The number of clutches per year, the number of eggs in a clutch, the date of oviposition and the incubation period of the eggs of *Podarcis filfolensis*.

Female	Year	Clutches	Clutch size	Date of oviposition	Incubation period/days/ (25-30°C)
<i>PFM</i>	1987	0	0	—	—
L=58mm	1988	0	0	—	—
	1989	1	4	05.01	—
	1990	2	3 ; 2	07.12 ; 08.06	—
	1991	2	3 ; 2	05.23 ; 06.23	— ; 51
<i>PFK</i>	1987	1	3	05.21	—
L=59mm	1988	1	3	04.21	—
	1989	1	2	05.16	—
	1990	0	0	—	—
	1991	2	3 ; 1	05.27 ; 07.07	46 ; —

The length and width of the newly laid eggs were:

PFM 10.1-12.6 · 6.0-7.5 mm (\bar{x} = 11.0 · 6.8 mm; N=9)

PFK 12.1-14.5 · 6.6-8.0 mm (\bar{x} = 13.4 · 7.2 mm; N=6).

At a temperature of 25-30°C, the incubation period of the eggs was 51 days in the case of *PFM* (from among five eggs, only one young was hatched) and 46 days in the case of *PFK* (from among three eggs, all the eggs hatched simultaneously). Incubation at lower temperatures (22-28°C) was unsuccessful.

In the case of *PFM*, the total length of the newly hatched young was 65mm (L = 24mm, Lcd = 41mm); in the case of the three *PFK* young it ranged from 69 to 74mm (L = 26-27mm, Lcd = 43-47mm). By 5 months the *PFK* young measured 108-109mm (L = 34-37mm, Lcd = 71-74mm). In this phase, their mean absolute and specific growth rates (computed after Clarke 1974) were 0.24 mm/day and 0.003 respectively. A comparison of the rate of absolute snout-vent length growth (0.05 mm/day) and tail growth (0.19 mm/day) shows

that the growth of the tail is positively allometric during the first months of the animal's life ($L/L_{cd} = 0.60$ at hatching and 0.48 at 5 months).

The young are light brown, with fine, irregular darkish markings which become progressively darker. Blue spots began to appear on their sides at 2.5-3 months (Fig. 1).

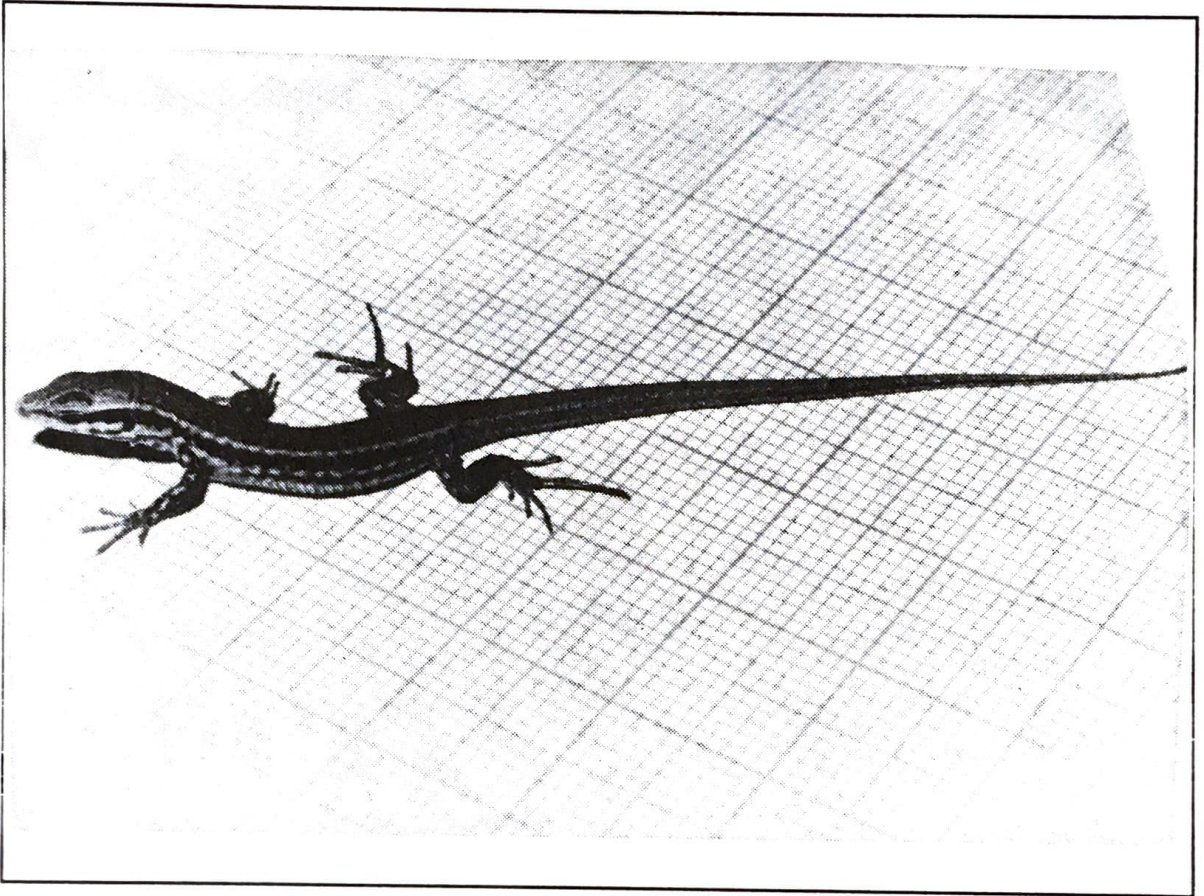


Fig. 1. Newly hatched young of *Podarcis filfolensis kieselbachi*.

The dimensions of the eggs of *P. filfolensis* and the length of their development are more or less within the range of values for other species of the genus *Podarcis* (for a survey of the data of different authors see Böhme, 1986).

It is difficult to evaluate the number and size of the individual clutches of *P. filfolensis* on the basis of the data obtained from only two females. As with other wall lizard species, we so far have few detailed data at our disposal. That leaves us with the question of whether the small number of clutches and eggs laid here by *P. filfolensis*, compared with other species, was a consequence of the small number of the animals studied and of differences in their conditions due to breeding in captivity, or whether it corresponded to the actual situation under natural conditions. Our data are comparable with those given for *Podarcis lilfordi*, for instance (the incidence of *P. lilfordi* is

likewise confined to small islands and there is probably just one clutch of 2-4 eggs a year - Salvador, 1986), so that this may possibly have something to do with the specific conditions of life on small islands. Likewise, similar values are given for certain continental species e.g. *Podarcis hispanica* with 2-3 clutches, and 1-4 eggs, and *P. peloponnesiaca* with 1-3 clutches and 3-4 eggs (Salvador, 1986; Bringsøe, 1986). For a detailed evaluation, however, we need more exact information on the number and size of eggs of *P. filfolensis* in the open. A knowledge of these basic factors - basic from the aspect of the population dynamics of wall lizards - would also be valuable for the protection of small island populations of this species.

Summary

The Maltese wall lizard, *Podarcis filfolensis*, is an endemic species of the Maltese islands, Lampedusa, Linosa and probably also Pantelleria. Because so little is known about the breeding biology of this species (see Bischoff 1986), two pairs of *Podarcis filfolensis* 1. *P. filfolensis maltensis* (PFM) from the islands Malta and Gozo, 2. *P. filfolensis kieselbachi* (PFK) from the island San Paul were kept under captive conditions for five years to observe their breeding.

It was found that females laid 1-2 clutches per year, each consisting of 2-4 eggs (PFM) and 1-3 eggs (PFK). The total clutch size was 4-5 eggs for PFM and 2-4 eggs for PFK, respectively. Egg length and width ranged from 10.1-12.6 mm and 6.0-7.5 mm (PFM) and from 12.1-14.5 mm and 6.6-8.0 mm (PFK) when laid. The incubation period, at 25-30°C, was 51 days (PFM - 1 egg) and 46 days (PFK - 3 eggs). At hatching the young ranged in snout-vent length from 24mm (PFM) to 26-27mm (PFK). The average snout-vent length of five months old hatchlings (PFK) was 35mm and their average body and tail absolute growth rates were 0.05 mm/day and 0.19 mm/day, respectively.

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