

SURVIVAL OF AN ARTIFICIALLY HYBRIDIZED POPULATION OF *PODARCIS PITYUSENSIS* AT DAU GRAN: EVOLUTIONARY IMPLICATIONS

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Abstract: A very small population (five lizards in 1998), product of the hybridization of *P.p.maluquerorum* and *P.p.pityusensis*, released by M. Eisentraut in 1930 survives in Dau Gran islet (Ibiza, Balearic Islands). The study of hybrids collected in 1935 and three present day specimens (two males and one female) allow to verify a tendency towards an increase in body size and a darker coloration of lizards. We consider that cannibalism is one of the principal selective factors in these extreme conditions that imply relatively quick evolutionary changes. This population can be representative of other populations also living in small islets with limited resources.

Keywords: artificial hybridization, *P. p. maluquerorum*, *P.p. pityusensis*, evolutionary changes.

Resumen: Supervivencia de una población de *Podarcis pityusensis* artificialmente hibridada en Dau Gran: Implicaciones evolutivas.- En el islote Dau Gran (Ibiza) sobrevive una mínima población (5 ejemplares en 1998) producto de una hibridación de *P.p.maluquerorum* y *P.p.pityusensis*, liberadas en la isla en 1930 por M.Eisentraut. El estudio de los híbridos capturados por un colector en 1935, y los ejemplares actuales (dos machos y una hembra) permiten constatar una tendencia al incremento

de la talla y oscurecimiento de la coloración. Se considera que el canibalismo es uno de los principales factores de selección en estas condiciones extremas, que implican cambios evolutivos relativamente rápidos. Esta población puede resultar representativa de otras que viven igualmente en islas de pequeña extensión y recursos muy limitados.

Palabras clave: Hibridación artificial, *P.p.maluquerorum*, *P.p.pityusensis*, cambios evolutivos.

Resumen: Supervivencia d'una població de *Podarcis pityusensis* artificialment hibridada en es Dau Gran: Implicacions evolutives.- A l'illa des Dau Gran (Eivissa) sobreviu una mínima població de sargantanes (5 exemplars el 1998) producte de la hibridació de *P.p.maluquerorum* i *P.p.pityusensis*, alliberades a l'illa el 1930 per M.Eisentraut. L'estudi dels híbrids capturats per un col·lector el 1935, i els exemplars actuals (dos mascles i una femella) permeten constatar una tendència a l'increment de la talla i l'obscuriment de la coloració. Es considera que el canibalisme és un dels principals factors selectius en aquestes condicions extremades, que impliquen canvis evolutius relativament ràpids. Aquesta població pot resultar representativa d'altres

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que viuen igualment en illes de petita extensió i recursos molt limitats.

Paraules clau: Hibridació artificial, *P.p.maluquerorum*, *P.p.pityusensis*, canvis evolutius.

INTRODUCTION

In 1930, the herpetologist Martin Eisentraut released eight males of *Podarcis pityusensis gorrae* from Escull Vermell islet (Ses Bledes group, W of Ibiza island) and 20 females of *P.p.pityusensis* from Ibiza island at Dau Gran, an islet close to Ibiza Port and devoiding its own lizard population. The objective was to make an hybridisation experiment in natural conditions. Today, the subspecies *P.p.gorrae* is considered synonymous of *P.p.maluquerorum* Mertens 1921 (MERTENS & WERMUTH, 1960).

Five years later, in 1935, a professional collector, Hans Grün, captured at the islet six hybrid specimens (three males and three females) that were send to the Herpetological Collection of Alexander Koenig Museum in Bonn (Germany). Deposited lizards remained unstudied until the seventies. In 1981 a descriptive work from these specimens and their origin was published (BÖHME & EISENTRAUT, 1981). Unfortunately, it does not include any information about the number of lizards not collected in 1935. Obviously, some specimens remained in the islet, as the following observations demonstrate.

During a visit in 1978, for a general report about Balearic islets (BENNASAR *et al.*, 1979), we detected the presence of

one male at the islet. Such limited observation can be explained by the late date of the survey, during the month of December. It was a large specimen of dark brown, but not black colour. We do not studied the remaining characteristics of this lizard. MARTÍNEZ-RICA & CIRER (1982) also quoted the capture of one specimen, some years before their publication, without additional information, and considering it as introduced.

After reading the publication of German herpetologists, on 11th July 1998 we captured three specimens (two males and one female) and we studied them at the laboratory, releasing them at the islet after the study. During a period of five hours of observation at the islet, we estimated a whole population of five lizards. Thus, we were unable to capture two of them. Scallation and biometrical data are included in Table 1, where we added the data of hybrids captured in 1935 (BÖHME & EISENTRAUT, 1981) as well as those specimens from the two parental populations according with the publications below cited. The data of scalation and biometry were obtained from living lizards submitted during some minutes to low temperatures, that allowed a better handling. Later, the specimens were send to forestry guards of Ibiza that released them at the islet. During this visit, they detected only the two additional lizards previously observed by us.

To compare hybrids from 1998 and those from 1935, we asked Dr Böhme of Alexander Koenig Museum (Bonn) for the temporal loan of specimens from 1935 captured on the islet. In Table 1 we show the results of this study.

The coloration of hybrids from 1998 y relation to those of 1935 is presented in Table 2.

We have to take into account that specimens from 1935 were preserved

during 45 years in alcohol when they were studied. Thus, the coloration was clearly altered. Even that, it seems possible to conclude that it has been a tendency towards darkening and that

MALES					
		<i>P.p. maluquerorum</i>	<i>P.p. pityusensis</i>	Hybrids 1998	Hybrids 1935
1	Snouth-vent length	67-74, 83 -83	60- 62,25 -67	75-83	80-84
3	Head length			24-29	28-29,7
3	Intertympanic width		10,6	10,2-12,7	10,8-13,2
3	Pileus length		16,8	18,3-20,2	20,4-20,7
3	Pileus width		8,4	9,3-9,9	9,8-10,3
3	Foreleg length		22,2	25,5-24,7	20,4-25,4
3	Dorsal longitudinal rows		137,7	137-143	146-149
1	Dorsal transversal rows	61- 65,7 -70	59	63-70	62-66
2	Supralabial scales			9-9	7-8
2	Infralabial scales			9-8	6-7
3	Collar scales		11,8	12-12	10-11
2	Gular scales	28		30-31	30-33
3	Ventral transversal rows		26,4	30-26	24-26
2	Femoral pores	22	21,9	25-20	19-21
2	Lamellae under 4 th toe	27	27,4	33-?	30-31
FEMALES					
		<i>P.p. maluquerorum</i>	<i>P.p. pityusensis</i>	Hybrids 98	Hybrids 35
1	Snout-vent length	59- 66,52 -74	58- 62,25 -67	76	63-72
	Tail length			113	74-135
3	Head length			28	20,7-26
3	Intertympanic width		7,64	9,3	8,5-9,4
3	Pileus length		12,56	16	14,9-17,5
3	Pileus width		6,32	8,2	7,0-8,4
3	Foreleg length		16,8	23,6	17-24
3	Dorsal longitudinal rows		136,3	148	144-146
1	Dorsal transversal rows	58- 61,09 -67	54- 55,75 -58	63	57-63
2	Supralabials			9	8
2	Infralabials			10	6
3	Collar scales		10,7	11	10-11
2	Gular scales	30	29,8	29	30-31
3	Ventral rows		27,3	30	25-28
2	Femoral pores	20,5	20,8	18	20-23
2	Lamellae under 4th toe	27,5	27,9	28	28-31

Table 1. Comparative data of biometry and pholidosis of hybrid specimens from Dau Gran and lizards from parental subspecies, according to literature cited. Data of column 3 were taken from living specimens and those of column 4 from preserved specimens. For data from literature we give the mean (bold) and range of variation, according to the following papers: 1: Comparative data of Böhme & Eisentraut (1981); 2: Salvador (1984), for *P.p. maluquerorum*; Cirer (1981) for *P.p. pityusensis*; 3: Cirer (1981) for *P.p. pityusensis*.

	1935 (Böhme & Eisentraut 1981)	Hybrids 1998
General back colour	Black, brown or grey. One specimen was green	Black with blue-greenish
Dorsal pattern	Black	Visible but with light contrast
Labial scales	Lighter	Slightly lighter
Pileus pattern	Dark brown or black, very vermiculated	Poorly or no contrast
Ventral colour	Black grey or withish	Blue
Pectoral scales	Not described	Slightly more greenish and grey
Troath	Reticulated	As pectoral scales
Ventral scales	With blue-greenish spots	Not distinctive
Femoral pores	Grey	Grey
Colour of inner hindleg	Paler than the belly	Not distinctive
Axillary spots	Present in one specimen	Blue (one specimen)
Variability	Two very different types	Reduced variability

Table 2. Comparison of coloration of Dau Gran hybrids between 1935 and 1998 (according to the literature, the living and preserved specimens)

ventral colour has been lack reticulation, turning to a more intense blue colour. The original variability described for specimens of 1935 disappeared, even if the study of only three specimens limits that conclusion.

It is particularly interesting to stand out the survival capacity of lizards in very hard conditions. The islet has a surface of less than 300 m², but less of 100 m² is covered by plants and inhabited by lizards. The limestone islet has a rough surface (9 mts. of maximum elevation) and is covered by several crevices. It is permanently exposed to eastern storms and its soil is very poor with deep crevices in the summit and the western slopes. The vegetal cover is very limited: less than fifty individuals of *Suaeda* sp. and some lichens. Its has not been described this genus as a part of the diet of the Pityusic lizard (PÉREZ-MELLADO & CORTI, 1993). The islet is a landing site for seagulls and shags and

their faeces could attract some insects, probably one of the few trophic resources for lizards. It is also possible the occasional capture of marine amphipods (abundant at these islets), even if lizards were only observed at the upper parts of the islet where these invertebrates are absent. In any case, it is probable that lizard population never reached ten individuals, excepting during the first years after the introduction. Grün probably tried to collect as much specimens as possible (the time and the person were not particularly prone to conservation ethics).

Interestingly, both captured males had regenerated tails and seven amputated toes: one specimen lacked its 3rd toe of right foreleg and the other male lost six digits: 2nd and 5th of left foreleg, 1st and 4th of one hindleg and 2nd and 4th of the other. On the other hand, the female has all its toes and an intact tail.

Probably, this very high frequency of amputations indicates an intense intraspecific competition between males. The tails, carrying fat reserves, must be particularly desirable (PÉREZ-MELLADO *et al.*, 1997) and territorial aggressions can be frequent. Obviously, natural selection conditions are very hard and selective forces could act at the intraspecific level, both for trophic and reproductive reasons, as amputations seems to confirm. In this sense, we can suppose that Grün was unable to extinct the population only because in 1935 its size was higher and because the lizards itself were a trophic resource for their conspecific. That is, the introduced population probably was cannibalistic and this behaviour allowed during generations the survival of a higher lizard number in the islet than the sustainable population size with its limited trophic resources. It would be interesting to make ethological observations at the islet, especially during mating period and then during the raise of hatchlings.

The lizard population of Es Dau suffers a hard selection pressure, probably due to its cannibalistic behaviour. The more vigorous individuals would have better probabilities to capture young conspecific, as well as to avoid their own capture. The body size of studied specimens and, especially, the size of the female is higher than any published value of body size for parental populations and indicates a positive selection for body size. In these conditions it is difficult to accept the existence of genetic drift, because the selective pressure is much more

important. It is important to stress that the speed of evolutionary change in body size is notable and higher than normally supposed at small islands. This phenomenon is fully similar to morphological changes of Darwin's finches of the genus *Geospiza* of Dafne Island (Galápagos Archipelago) described by Grant and their students (WEINER, 1994).

Obviously, from so few specimens and a so limited time of study we can extract only provisional conclusions. Anyway, it is interesting to show the interest of this population and to invite the specialists to develop a deeper study. Probably, the factors acting at Es Dau are similar to those acting at other insular populations but perhaps it is easier to interpret them in this extreme situation for the survival of the species.

CONCLUSIONS

The survival capacity of a very small population in very hard conditions is demonstrated by the existence of hybrids almost 70 years after their introduction in a very limited biotope with a poor set of resources.

Large body size and dark colouration are positively selected in this kind of small and rocky islet through a selective process via competition and intraspecific predation.

The speed of morphological changes is very high and produced a body size shift of hybrids reaching in the case of females a larger body size than any previously recorded in parental subspecies.

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