REPRODUCTION IN THE GREEK ENDEMIC LIZARD *Podarcis milensis* (SAURIA: LACERTIDAE)

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INTRODUCTION

- Reproductive traits together with life history information, help us understand the evolution of life history strategies in lizards (Tinkle *et al.*,1970). Evolutionary and ecological factors affect the reproduction of the species (Vitt and Price, 1982). Studies on the reproductive traits of the lizard populations in the Aegean Archipelago (Greece) could reveal the factors that affect the reproduction of these species. The main characteristics of the area are the different geological history of each island, the influence of man and the fluctuation of the enviromental factors.
- *Podarcis milensis* is an endemic lizard species of the Milos island group, occuring on Milos, Kimolos, Antimilos, and the surrounding islets. It is the only small lacertid in the area. It is a robust, deep-headed lizard with a characteristic colour pattern in males. Adults measure up to about 65mm (SVL) (Arnold & Burton, 1978).
- Almost nothing is known about the life history traits of *P. milensis*. In this work we present the main features of the reproduction of this species. This knowledge is most valuable, in particular for its conservation and protection.

MATERIAL AND METHODS

- A total of 91 adult males and 209 adult females of *Podarcis milensis* were used for the analysis. All animals come from Museum collections.
- The following measurements were taken for each specimen: a/ snout-vent length (SVL), b/ shortest and longest diameter of each testicle, c/ number and diameter of the ovarian follicles, d/ number, length and width of oviductal eggs.
- Sexual maturity was assessed by the presence of enlarged ovarian follicles (>3mm diameter) or oviductal eggs . The estimate of testicle and egg volume was obtained using the formula for the volume of an elipsoid:

$$V = 4/3 * \pi * a/2 * (b/2)^2$$

where *a* is the longest diameter and *b* the shortest. In the analysis we used: clutch volume (CV) as the sum of the total egg volume of each animal and mean egg volume (MEV) as the clutch volume/ number of oviductal eggs for each animal (Frankenberg & Werner, 1992).

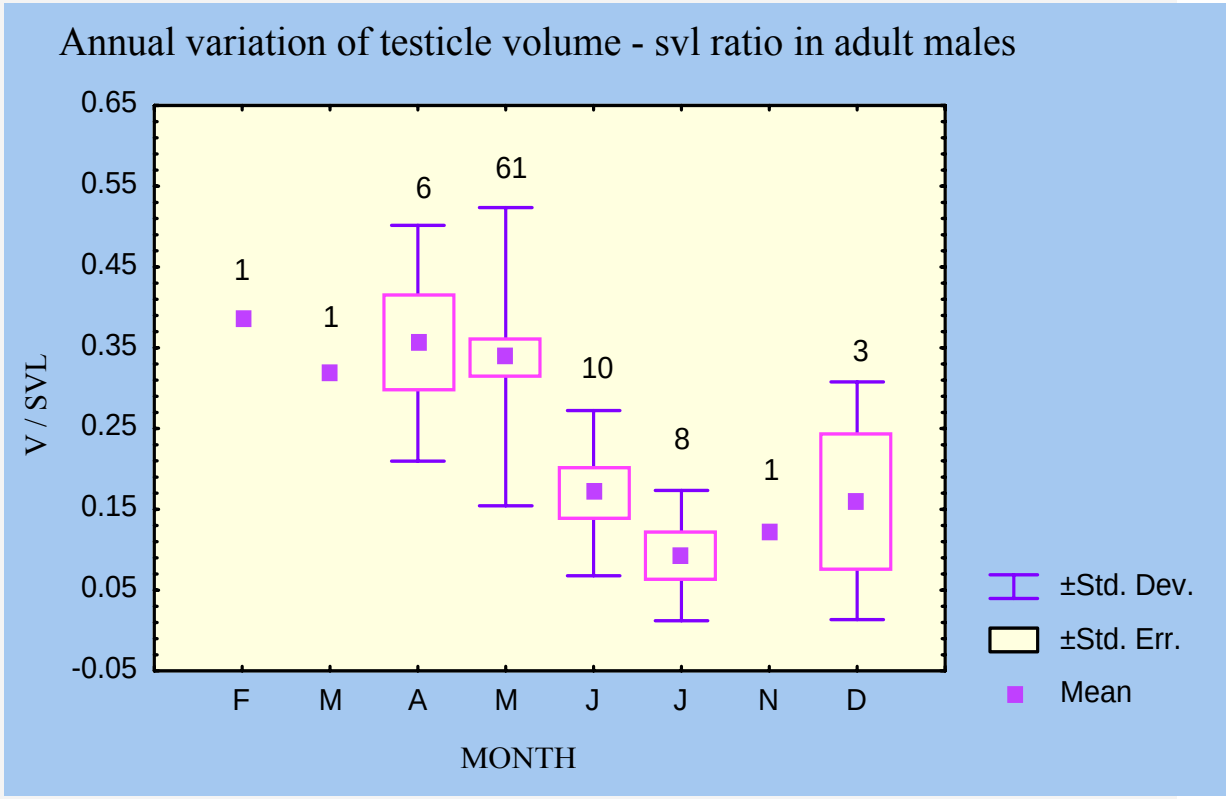
- We determined the time of hatching and SVL of hatchlings in the field by the presence of the ventral navel scar (Galan, 1996).
- The growth pattern of individuals is described by the von Bertalanffy equation (von Bertalanffy, 1938).

RESULTS
Field observations

- *Podarcis milensis* remains active all year. Mating behaviour and copulations start from January and last until July but occur mainly during spring, as indicated by external signs such as the presence of mating scars on females and the bright blue-green spots on males. During January and February, mostly large females (SVL>50) took part in the copulations.
- Females seem to lay eggs from the middle of March and continue until the end of August. We had two cases of oviposition in the laboratory on 20/3/97 and 25/3/97 (mean egg length: 14.5 mm, mean clutch size: 2 eggs). Furthermore the presence of large oviductal eggs (>12 mm) during March and during the end of July in the Museum specimens support the above observations.
- The first hatchlings appear in the middle of April and the last at the end of October. They have an SVL of 24-31 mm.

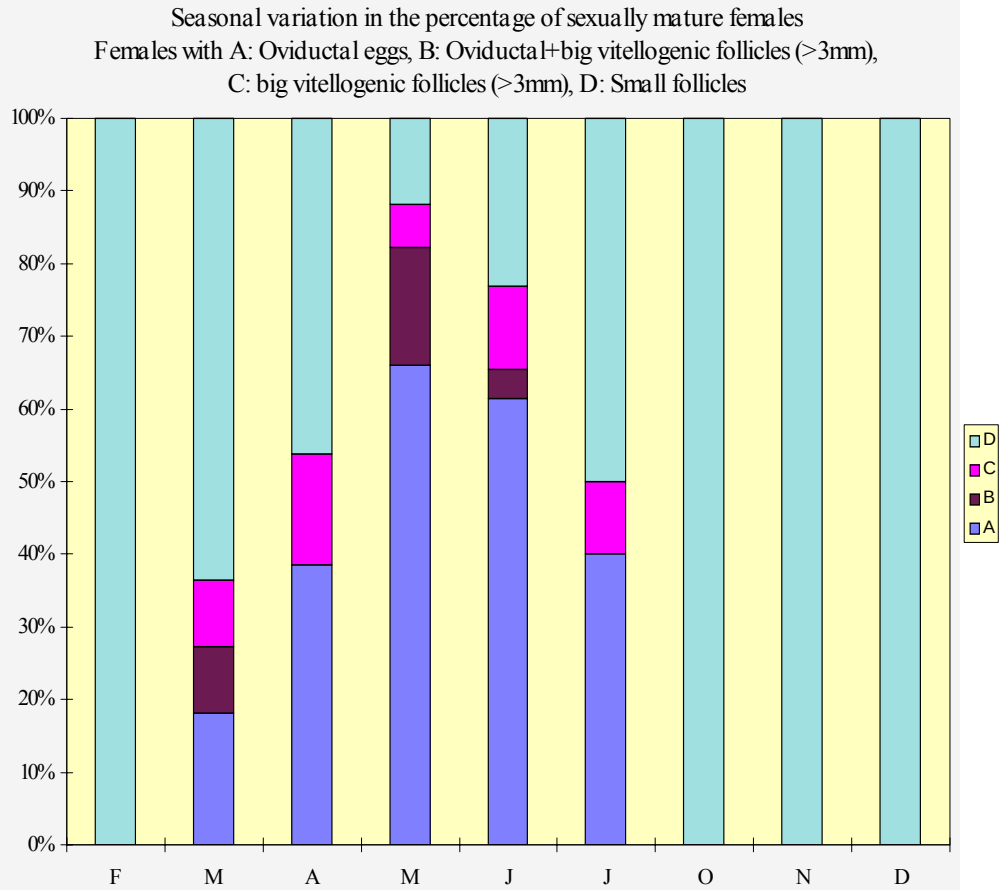
MALES

- The minimum body-size (SVL) found for a reproductive male was *47* mm.
- Testes reached their maximum volume between April and May. During summer the testes volume decreased; a gradual increase began in November and continued until December.
- There was a significant difference between the months if plotted against the volume-svl ratio (ANOVA, $F_{7,83}$: 3.63, $p<0.05$).



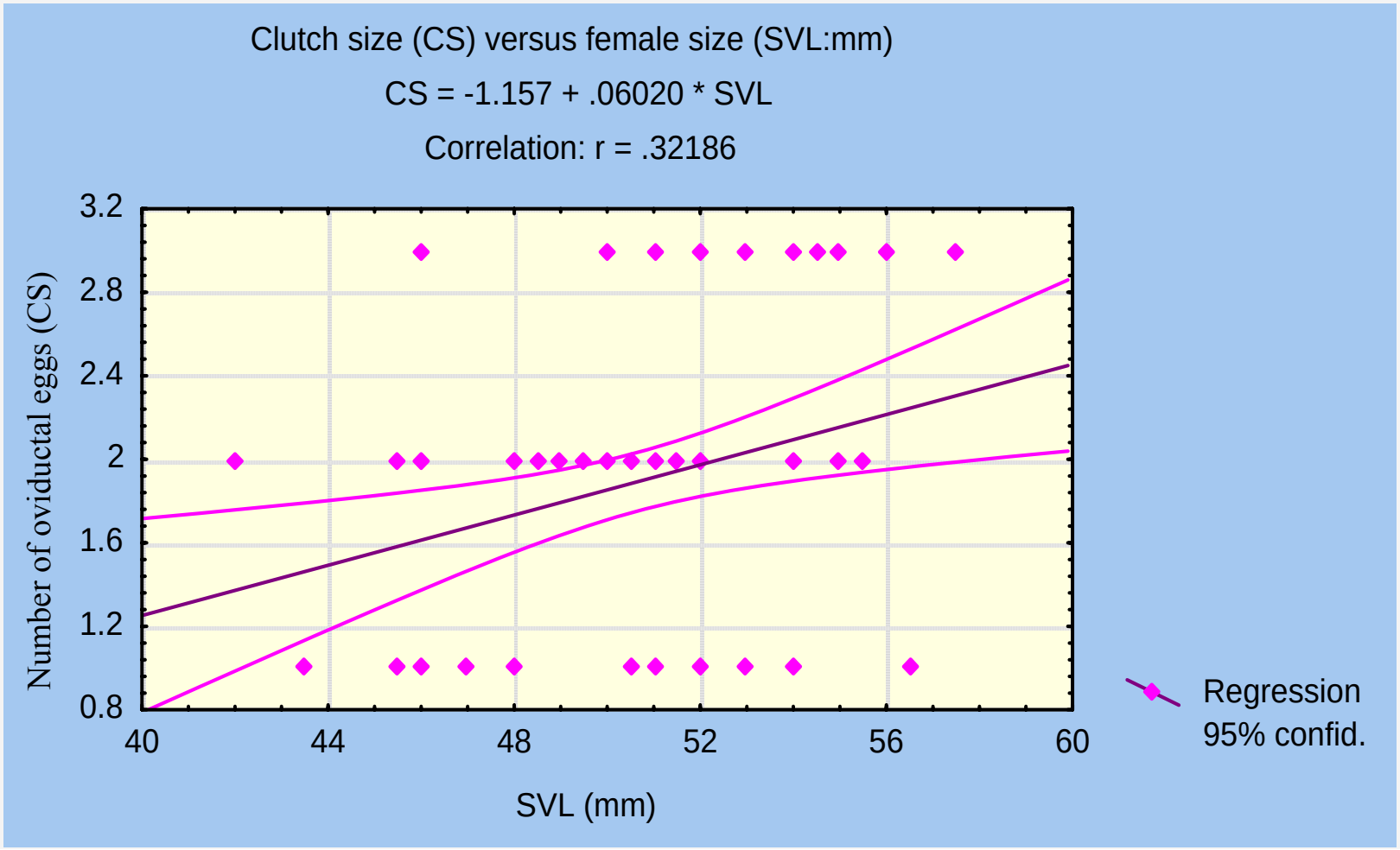
FEMALES

- The smallest reproductive female had a length (SVL) of ***42*** mm.
- The mean clutch size is x=***1.8*** eggs (range=1-3, S.D.=0.649, n=99)
- The mean second clutch size is x=1.31(range=1-2, S.D.=0.471, n=35). The first clutch has a significant difference from the second, (t test: t-value=4.12, $p<0.05$).
- Large vitellogenic follicles (>3mm) were first seen in March. Their presence in May and April indicate that *Podarcis milensis* lays at least two clutches per year. From October all females were reproductively inactive.



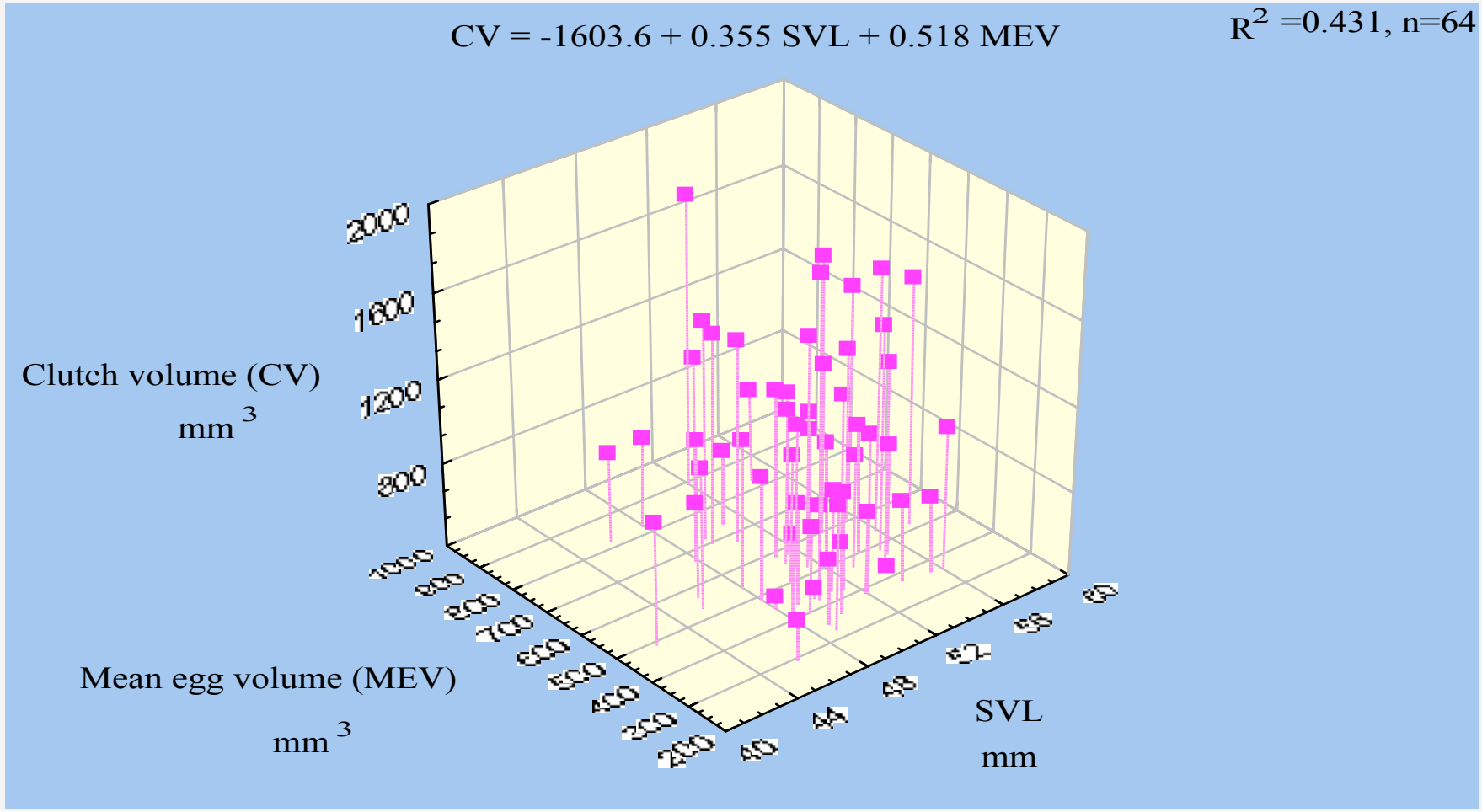
Clutch size and female body size

Clutch size (CS) was slightly related to SVL (r= 0.321, p<0.05).



Clutch volume vs. mean egg volume & SVL

Total clutch volume (CV) was strongly related to mean egg volume (MEV) and SVL. Partial correlations: CV to SVL=0.424, CV to MEV=0.563, $p<0.05$. Viewing total clutch volume as a sphere with a diameter d, the mean ratio d/svl is 23.9, S.D.=3.0



Growth rate

The body size distribution of females and males of *P. milensis* (May specimens) revealed the following growth parameters:

- ***Males***

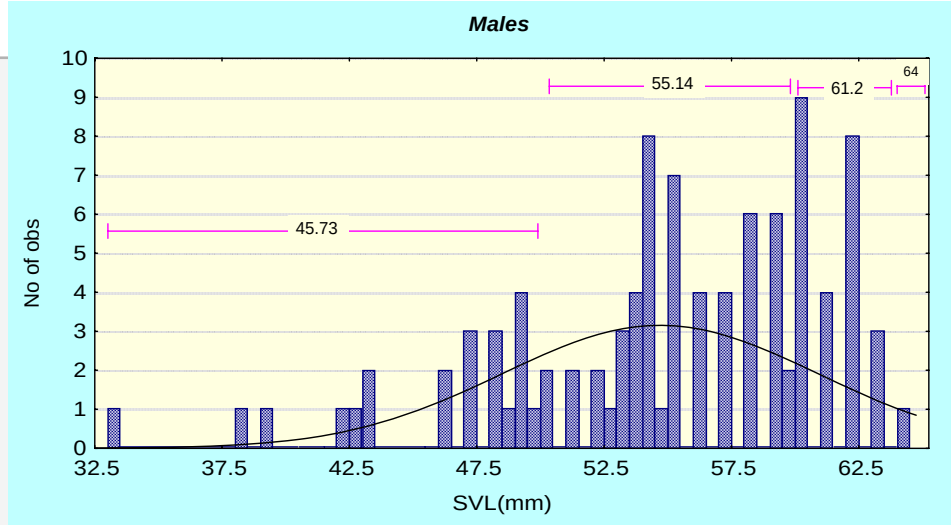
Lmax = *68* mm, k= *0.54*, t_0:-1.13

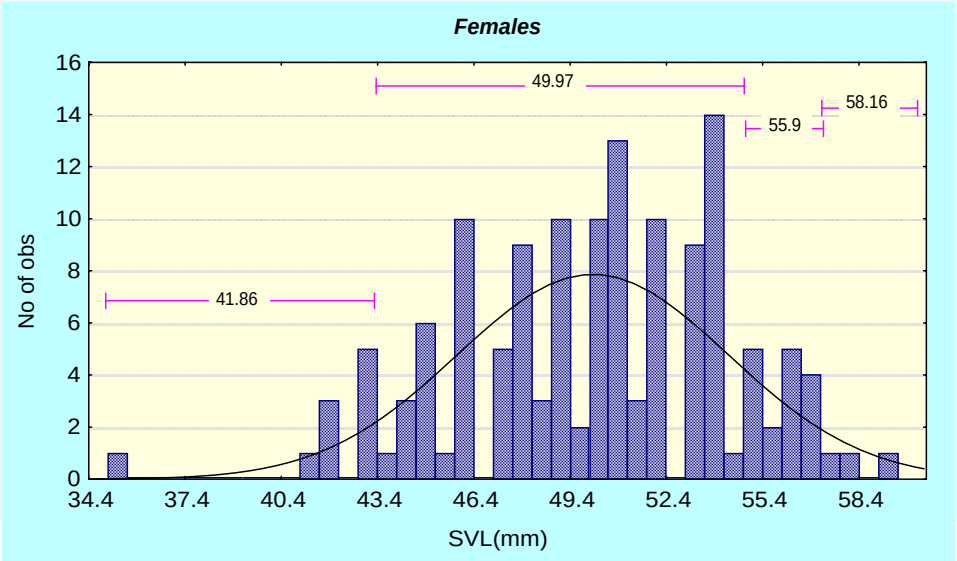
- ***Females***

Lmax = *63* mm, k=*0.52*, t_0: -1.22

Field observations verify our results of Lmax since we never found larger animals on Milos island.

From the distributions it seems that at least four age classes exist.



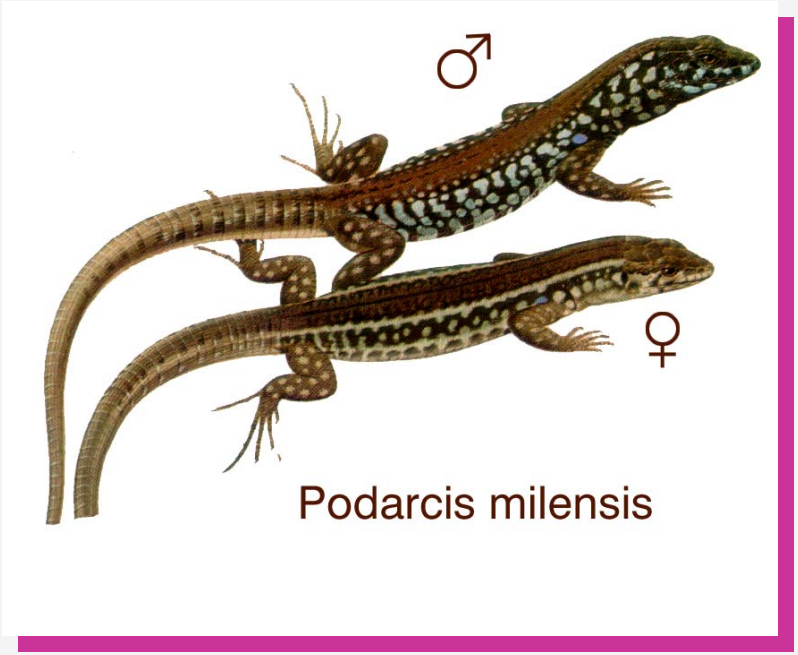


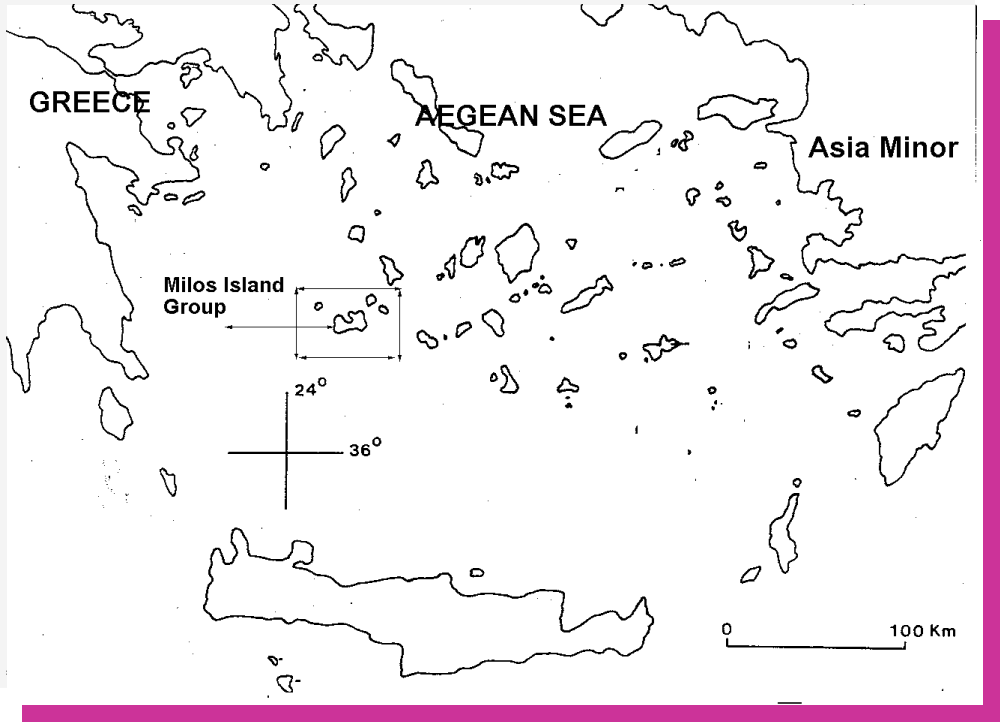
DISCUSSION

- *Podarcis milensis* shows a seasonal reproductive phenology like the other *Podarcis* species of the area (Chondropoulos & Lykakis, 1983; Valakos, 1990; Maragou, unpub.data). The reproductive period of the species begins in January and lasts up to October. *P. milensis* has a longer reproductive period than the other *Podarcis* species of the area.
- The testicular cycle shows a typical pattern like the other lizards of temperate zones (Fitch, 1970).
- *P. milensis* is an early maturing, multilpe-brooded species with a small clutch size. The reproductive traits of this species differ not only from *Podarcis erhardii* which is distributed in the insular ecosystems of the Aegean (Valakos, 1990) but also from the other Greek *Podarcis* species (Chondropoulos & Lykakis, 1983; Maragou, unpub. data). All the above species have larger clutches than *P.milensis* and they mature in the second year after their birth. The endemic Ibiza wall lizard (*Podarcis pityusensis)* shows the same differences with the other Iberian members of the genus *Podarcis* (Carretero *et al.*,1995).

- In 1970 Tinkle *et al.* tried to approach the different reproductive strategies followed by different species of lizards. They stated that lizards maturing at early age also mature at a smaller body size, have shorter adult life expectancies, they are usually multiple-brooded and have smaller mean clutch size than do late maturing lizards. *P. milensis* seems to follow the first strategy producing few and large eggs at least twice a year.
- This strategy together with the extension of the reproductive period give an advantage to the newborns in order to survive during summer, when the food supply is very low (Karamaouna, 1987) and to utilize the high food availability during the wet season.
- These first data on the reproduction of *P.milensis* from Milos island, indicate that this species is better adapted to the insular Mediterranean-type ecosystems of the Aegean, in relation to the other *Podarcis* species of the area. The old isolation of the Milos Island group (since the upper Pleistocene, Papanikolaou & Dermitzakis, 1981), forced the species to adopt a strategy which gives the animals an opportunity to cope with the special and unpredictable conditions of the Mediterranean-type ecosystems. The same adaptations appear also in the old isolated *Podarcis* populations of the Balearic archipelago (Carretero *et al*., 1995).

THE SPECIES & ITS DISTRIBUTION





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