

Preliminary data on the biometry and the diet of a micro-insular population of *Podarcis wagleriana* (Reptilia: Lacertidae)

PIETRO LO CASCIO ¹, SALVATORE PASTA ²

¹ Associazione Nesos, via Vittorio Emanuele 24, I-98055 Lipari (ME). E-mail: pietrolocascio@libero.it

² via Salvatore Bertini 9, I-90129, Palermo. E-mail: salvopasta@alice.it

Abstract. The results of some investigations on the *Podarcis wagleriana* population of La Scuola Islet (Stagnone Lagoon Archipelago, W Sicily) are here presented. Adult mean SVL was 69.5 mm and 61.6 mm for males and females respectively. The analysis of faecal pellets showed that the most important prey types were Formicidae (32%), Coleoptera (15%), and other Hymenoptera (13%). The proportion of vegetal matter (occurring in 35% of the examined pellets) was higher than in Sicilian populations, suggesting that plant consumption in this micro-insular environment may play a more significant role in the diet of the species.

Keywords. *Podarcis wagleriana*, ecology, Sicily, Stagnone Islands, micro-insularity.

Despite of its considerable importance both from zoogeographical and conservational points of view (Lo Valvo, 1998), present information on the endemic Sicilian Wall Lizard, *Podarcis wagleriana* Gistel, 1868, is still fragmentary and almost lacking (Böhme, 1986; Corti and Lo Cascio, 2000; Capula, 2006). The distribution of this species includes Sicily and several circum-Sicilian islands (Turrisi and Vaccaro, 1998; Corti et al., 2006). *P. wagleriana* is sympatric with the Italian Wall Lizard (*Podarcis sicula*) in all its range, but on La Scuola, the smaller islet where the species occurs, it is the only Lacertid lizard (Lo Valvo and Massa, 1999). In this paper we present and discuss the preliminary data on the biometry and the trophic ecology of this population.

La Scuola (37°51'76"N-12°27'39"E Greenwich) is the smallest islet of the Stagnone Archipelago, located 1,650 m off the W Sicilian coast. It has a surface of 8,100 m² and a maximum elevation of 3 m a.s.l. The islet is nowadays uninhabited, but it was used during the 20th century as a "lazaretto" (hospital for epidemic illnesses). Sandy and rocky seashores are fulfilled with rotten leaves of marine plants, while several chenopod species (such as *Arthrocnemum macrostachyum* and *Halimione portulacoides*) cover the slopes along the perimeter of the islet. On the flat top, *Lygeum spartum*-dominated halo-xerophilous grassland occurs, with few scattered species-poor assemblages in the seagull nesting areas (dominated by *Chrysanthemum coronarium* and *Galactites tomentosa*). Apart from *P. wagleriana*, the Ocellated Skink (*Chalcides ocellatus*) is the only reptile species so far

recorded for the islet (Lo Valvo and Massa, 1999). Among the other vertebrates, Mediterranean Yellow-legged Gull (*Larus cachinnans*) has colonised the islet since the 1980s with about 15-20 nesting pairs (Lo Valvo and Massa, 1999); we also observed several marks of rats, probably *Rattus rattus*. Since 1984 La Scuola has been included as protected area in the Riserva Naturale Orientata "Isole dello Stagnone di Marsala".

The islet was visited in the early June 2004. All the collected lizards were sexed, examined and released in the field. For each lizard, snout-vent length (SVL) and tail (if not regenerated) were measured with a "Mauser" calliper (0.1 mm accuracy). The faecal pellets were obtained from handled specimens or collected from the substrate in areas where lizards' activity was previously observed, in order to avoid confusion with those of the sympatric *Chalcides ocellatus* (which pellets are anyway characterised by different shape and size [pers. obs.]). Faecal contents were examined in the laboratory under a stereoscope. Remains were identified at order or family rank; prey length was obtained measuring the remains with a micrometer eyepiece and calculated by using regression equations (Hódar, 1997). When it was possible, plant matter and seeds were identified by comparing them with fresh vegetal samples collected on the islet. Statistical analyses were done by using SPSS 11.5 for Windows PC package, with alpha set at 5% and all tests being two-tailed.

Adult males SVL range from 65 to 75 mm ($n = 8$, mean = 69.50, SE 1.50), whereas adult females range from 59 to 64 mm ($n = 8$, mean = 61.50, SE 0.68). As expected, and despite the very small sample size, population body size differed significantly among sexes (one-way ANOVA: $F_{7,8} = 37.39$, $P = 0.0001$), with males bigger than females. Tail length range from 123 to 146 mm in males, and from 85 to 123 mm in females. Among the measured ($n = 16$) and the observed individuals ($n = 52$), only 3 on the whole had the tail broken or regenerated. Dorsal pattern did not differ from those of the Sicilian populations. Males resulted characterised by intensely yellowish (about 45% of the observed specimens) or reddish (about 30%) ventral parts, throats with dense dark spots, and noteworthy lateral maculae. Four specimens (3 males and 1 female) with a *concolor* pattern, that is characterised by the absence of dorsal design, were also observed. All the examined females exhibited marks of copula, and some of these revealed at palpation that were boring oviductal eggs.

We examined 20 faecal pellets (8 obtained from handle specimens and 12 collected from the substrate), from which remains of 65 preys were identified at family or order rank (mean = 3.25, SD = 1.67 identifiable food items per pellet). The diet is mainly made up of arthropods, and Formicidae (32.3%), Coleoptera (15.3%) and other Hymenoptera (13.8%) are the most important preys (see Table 1). Five other taxa were detected in the prey spectrum with percentages of appearance below 10. Furthermore, plant consumption seems to represent a remarkable food resource for these lizards. Vegetal matter was found in 35% ($n = 7$) of the examined faecal pellets, with an average volume in percentage of 15.50 ± 5.64 SD per pellet. Prey size was determined in 83% ($n = 54$) of the total sample of consumed items. A size distribution peak results at 3-6 mm (Fig. 1), which matches very good with the average estimated length of the majority of Formicidae and Coleoptera preyed by lizards. Concerning the preys from the 8 faecal pellets obtained from handle specimens (3 males and 5 females), there are no significant correlation between SVL and mean prey size ($r = -0.073$, $P = 0.86$), number of preys ($r = -0.515$, $P = 0.19$), and no significant differences among sexes in the number of consumed preys (Kruskal-Wallis test, $H = 2.460$, $P = 0.11$). The food categories frequency did not differ significantly among sexes

Table 1. *Podarcis wagleriana* dietary composition expressed in terms of number of items (Ni), percentage of total (N%), and number (Np) of pellets containing that prey type. In the column N% vegetal matter is expressed in terms of average proportion of the total pellet volume occupied by plant matter.

Prey type	Ni	N%	Np
Animals			
Unidentified Arthropoda	7	10.7	6
Crustacea Amphipoda	4	6.1	4
Crustacea Isopoda	2	3.0	2
Araneae	3	4.6	3
Heteroptera	3	4.6	2
Coleoptera	10	15.3	6
Diptera	6	9.2	4
Hymenoptera Formicidae	21	32.3	11
Other Hymenoptera	9	13.8	6
Plants and seeds			
Vegetal matter	-	15.5	7
<i>Parietaria</i> seeds	11	-	2

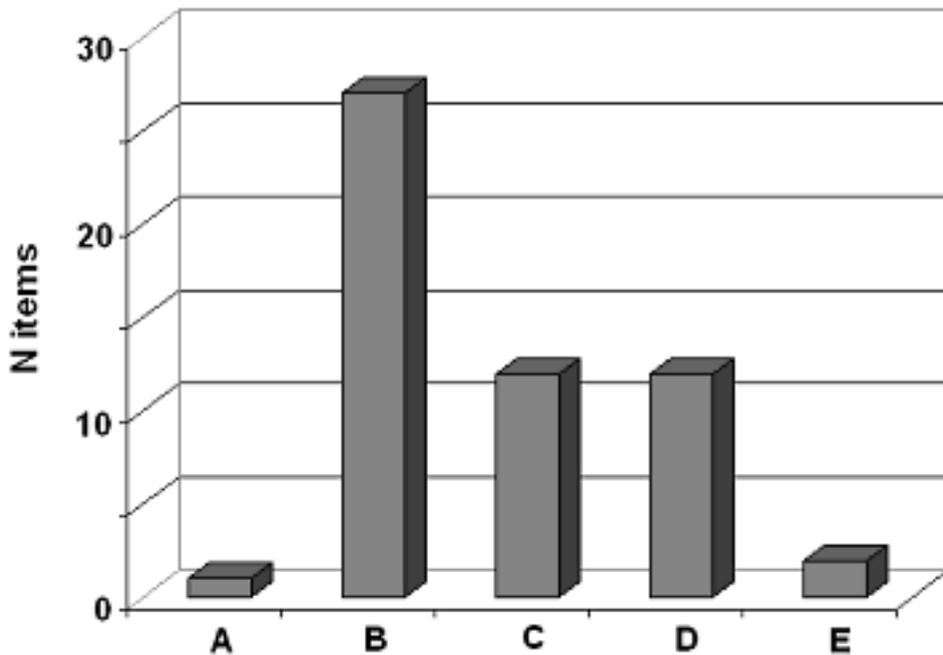


Fig. 1. Prey size distribution inferred from faecal pellets of *Podarcis wagleriana*. Symbols for prey categories: A, 0-3 mm; B, 3.1-6 mm; C, 6.1-9 mm; D, 9.1-12 mm; E, > 12 mm.

(χ^2 test = 6.916, 2×10 contingency table, $P = 0.66$). Anyway, it is interesting to observe that Crustacea Amphipoda were found only in females' pellets (3 out of 5), whereas no males' pellets contained this prey type.

As expected, the diet results mainly insectivorous, and the main bulk of prey is constituted by ants, which probably are the most common and abundant arthropods on the islet. Mirmecophagy is often frequent in insular populations of the genus *Podarcis* (e.g. Ouboter, 1981; Quayle, 1983; Chondropoulos et al., 1993; Pérez-Mellado and Corti, 1993; Adamopoulou et al., 1999; Grbac et al., 2001; Luiselli et al., 2004; Lo Cascio et al., 2004) and, even if in smaller percentage, Formicidae have been detected among the most important prey-groups of *P. wagneriana* also in the main island of Sicily (Sorci, 1990). On the contrary, the diet of the lizards at La Scuola includes both terrestrial (Coleoptera, Formicidae) and flying preys (other Hymenoptera, Diptera), while in Sicily it seems primarily based on terrestrial arthropods (Sorci, 1990). On this islet, *P. wagneriana* seems to use a broader variety of preys than in Sicily, consistently with the poor faunal assemblages which presumably occur on this environment. Therefore, it can be considered a trophic opportunist and a widely foraging predator (*sensu* Huey and Pianka, 1981). Amphipoda seem to be preyed almost exclusively by female lizards. These crustaceans have been found occasionally in the diet of coastal or micro-insular *Podarcis* (Pérez-Mellado and Corti, 1993; Davenport and Dellinger, 1995; Adamopoulou and Legakis, 2002), even if they did not result exclusive of any specific sex and/or age class among these populations. Also, we have seen lizards along the coastal belt, as far as the intertidal zone, catching sand-hoppers and other invertebrates over and into the rotten leaves of marine plants on the shore. Most part of them (13 out of 15) were females and only 2 resulted to be subadult males. A possible explanation is that sunny and exposed intertidal zones could represent just "peripheral" part of the lizards' territories and, thus, exploited mostly by subadults and females. However, if sand-hoppers can be considered as an economically profitable prey-type (due to their abundance, low searching cost, etc.), why adult males do not seem to use this source remains unexplained, and further investigations are needed to confirm the occurrence of different food electivity and/or foraging behaviour within this population. Finally, the rather high proportion of vegetal matter found in the pellets deserves special attention. It is well known that in insular environments, insectivorous lizards expand their diet to include plant parts (e.g. Sadek, 1981; Pérez-Mellado and Corti, 1993). Sorci (1990) has indicated a low percentage (about 5%) of plant matter within the dietary spectrum of this species in Sicily. Our results suggest that plant consumption is more conspicuous and widespread among the individuals of La Scuola population, judging from the high proportion of faecal pellets with vegetal matter. Plant parts (even seeds) have a high water and nutritional content and represent an important source of energy (Golley, 1961). Plant matter in the diet of these lizards seems to confirm the association between (partial) herbivory and insularity, which according to Van Damme (1999) can be interpreted as adaptation to (i) a reduced arthropod availability and (ii) a low predation pressure. At La Scuola, the potential predators can to be represented by the rat and the seagull, although this species is not considered an effective predator of lizards (see Araujo et al., 1977). Anyway, other traits, such as the low number of regenerated/broken tails (see Van Damme, 1999), suggest that only a fair predation pressure might occur on this islet.

ACKNOWLEDGEMENTS

We are grateful to Mr Felice Parrinello, who guided us dribbling the *Posidonia* banks of the “Stagnone”, and provided useful information about the history of La Scuola Islet; to Dr Claudia Corti and two anonymous referees, for the critical reviews of the manuscript. We are also indebted to Prof. Bruno Massa, who kindly allowed us to use the stereoscopic equipment at the SENFIMIZO Department of the University of Palermo.

REFERENCES

- Adamopoulou, C., Legakis, A. (2002): Diet of a Lacertid lizard (*Podarcis milensis*) in an insular dune ecosystem. *Israel J. Zool.* **48**: 207-219.
- Adamopoulou, C., Valakos, E.D., Pafilis, P. (1999): Summer diet of *Podarcis milensis*, *P. gaigeae* and *P. erhardii* (Sauria: Lacertidae). *Bonn. Zool. Beitr.* **48**(3-4): 275-282.
- Agnesi, V., Macaluso, T., Orrù, P., Ulzega, A. (1993): Paleogeografia dell'Arcipelago delle Egadi (Sicilia) nel Pleistocene Sup.-Olocene. *Naturalista sicil.* (4)**17**(1-2): 3-22.
- Araujo, J., Muñoz-Cobo, J., Purroy, F.J. (1977): Las rapaces y aves marinas del archipiélago de Cabrera. *Naturalia Hispanica* **12**: 1-94.
- Böhme, W. (1986): *Podarcis wagleriana* (Gistel, 1868) – Sizilianische Mauereidechse. In: *Handbuch der Reptilien und Amphibien Europas*, Bd. 2/II, Echsen (Sauria) III (Lacertidae III: *Podarcis*), p. 377-387. Böhme, W., Ed, Aula-Verlag, Wiesbaden.
- Capula, M. (2006): *Podarcis wagleriana* Gistel, 1868. In: *Atlante degli Anfibi e dei Rettili d'Italia*, p. 494-497. Sindaco, R., Doria, G., Razzetti, E., Bernini, F., Eds, Polistampa, Firenze.
- Chondropoulos, B., Maragou, P., Valakos, E.D. (1993): Food consumption of *Podarcis taurica ionica* (Lehrs, 1902) in the Ionian islands (Greece). In: *Lacertids of the Mediterranean region. A Biological approach*, p. 173-182. Valakos, E.D., Böhme, W., Pérez-Mellado, V., Maragou, P., Eds, Hellenic Zool. Soc., Athens.
- Corti, C., Lo Cascio, P. (2000): Le ricerche ecologiche sui Sauri italiani. In: *Atti I Congresso nazionale S.H.I. (2-6 ottobre 1996)*, p. 523-529. Giacoma, C., Ed. Museo regionale Scienze Naturali, Torino.
- Corti, C., Lo Cascio, P., Razzetti, E. (2006): Erpetofauna delle isole italiane. In: *Atlante degli Anfibi e dei Rettili d'Italia*, p. 613-643. Sindaco, R., Doria, G., Razzetti, E., Bernini, F., Eds, Polistampa, Firenze.
- Davenport, J., Dellinger, T. (1995): Melanism and foraging behaviour in an intertidal population of the Madeiran lizard *Podarcis* (= *Lacerta*) *dugei* (Milne-Edwards, 1829). *Herpetol. J.* **5**: 200-203.
- Golley, F.B. (1961): Energy values of ecological materials. *Ecology* **42**: 581-584.
- Grbac, I., Leiner, S., Perović, F. (2001): Thermoregulation and diet composition of insular populations of *Podarcis melisellensis* and *Lacerta oxycephala*. *Biota* **2**(suppl.): 38.
- Hódar, J.A. (1997): The use of regression equations for the estimation of prey length and biomass in diet studies of insectivore vertebrates. *Miscellanea Zool.* **20**(2): 1-10.
- Huey, R.B., Pianka, E.R. (1981): Ecological consequences of foraging mode. *Ecology* **62**: 991-999.

- Lo Cascio, P., Luiselli, L., Corti, C. (2004): Preliminary data on the ecology of *Podarcis filfolensis* at Lampione Islet (Pelagie Islands, Channel of Sicily). In: Abstracts book 5th Intern. Symp. Lacertids Medit. Basin, p. 25, Corti, C., Lo Cascio, P., Eds, Firenze University Press, Firenze.
- Lo Valvo, F. (1998): Status e conservazione dell'erpeto fauna siciliana. *Naturalista sicil.* (4)22(1-2): 53-71.
- Lo Valvo, F., Massa, B. (1999): Lista commentata dei vertebrati terrestri della Riserva Naturale Orientata "Isole dello Stagnone" (Sicilia). *Naturalista sicil.* (4)23(3-4): 419-466.
- Luiselli, L., Capula, M., Corti, C., Lo Cascio, P., Pérez-Mellado, V. (2004): Preliminary data on the feeding ecology of *Podarcis raffonei* (Reptilia, Lacertidae), a threatened endemic lizard of the Aeolian Islands (Mediterranean Sea). In: *The Biology of Lacertid lizards. Evolutionary and Ecological Perspectives*, p. 223-229. Pérez-Mellado, V., Riera, N., Perera, A., Eds, Institut Menorquí d'Etudis, Maò.
- Ouboter, P.E. (1981): The ecology of the island-lizard *Podarcis sicula salffi*: correlation of microdistribution with vegetation coverage, thermal environment and food-size. *Amphibia-Reptilia* 2: 243-257.
- Pérez-Mellado, V., Corti, C. (1993): Dietary adaptations and herbivory in Lacertid lizards of the genus *Podarcis* from western Mediterranean islands (Reptilia: Sauria). *Bonn. zool. Beitr.* 44(3-4): 193-220.
- Quayle, A. (1983): Notes on the diet of Erhard's Wall Lizard, *Podarcis erhardii*. *Brit. J. Herpetol.* 6: 309-310.
- Sadek, R.A. (1981): The diet of the Madeiran lizard *Lacerta dugesii*. *Zool. J. Linn. Soc.* 73: 313-341.
- Sorci, G. (1990): Nicchia trofica di quattro specie di Lacertidae in Sicilia. *Naturalista sicil.* (4)14 (suppl.): 83-93.
- Turrisi, G.F., Vaccaro, A. (1998): Contributo alla conoscenza degli Anfibi e dei Rettili di Sicilia. *Boll. Accad. Gioenia Sci. nat.* 30(353): 5-88.
- Van Damme, R. (1999): Evolution of herbivory in Lacertid lizards: effects of insularity and body size. *J. Herpetol.* 33(4): 663-674.