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PODARCIS PITYUSENSIS (Ibiza Wall Lizard). **DEATH-FEIGNING BEHAVIOR**

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PODARCIS PITYUSENSIS (Ibiza Wall Lizard). **DEATH-FEIGNING BEHAVIOR**. Many animals display thanatosis, or death-feigning behavior, as an anti-predatory mechanism (Arduino and Gould 1984. Anim. Behav. 32: 921–923; Sargent and Eberhardt 1975. Am. Midl. Nat. 94:108–109; Sazima 1974. J. Herpetol. 8:376–378), and while thanatosis has been widely documented in snakes (Gehlbach 1970. Herpetologica. 26:24–34) this behavior is much less common among lizards (Gallup 1973. Copeia 1973:623–624). Here, I present evidence that the *Podarcis pityusensis* feigns death after being held on its back for two to five seconds. Once this behavior has initiated, the lizard can be clapped at without moving—in some cases for an excess of five minutes. However, if one walks away from the lizard for more than a few seconds, the lizard quickly rolls over and attempts to escape.

Podarcis pityusensis is a diurnal, ground dwelling lizard endemic to Ibiza and Formentera (and nearby rocky islets) in the Balearic Island chain off the coast of Spain (Cirer and Martinez-Rica 1990. Herpetol J. 1:465–473; Martinez and Cirer 1982. Biol. Cons. 22:295–314). A host of animals prey on *P. pityusensis* including birds, snakes, and mammals (Alcover 1984. Saügetierkundliche Mitteilungen 31:189–195; Carretero 2004. Ital. J. Zool. 2:121–133; Pérez–Mellado 1988. Fauna Ibérica. 10:294–302).

Using a noose, I collected 96 *P. pityusensis* from five different populations. I captured 20 lizards from each of the following sites within the Balearic Islands: 1) Tagomago (39.037°N, 1.645°E), 2) Ses Salinas (38.822°N, 1.411°E), and (3) Mirador des Savinar (38.871°N, 1.411°E) on Ibiza, 4) the islet s'Espalmador (38.784°N, 1.425°E), and 16 lizards from 5) Es Trocadors (38.766°N, 1.435°E) on Formentera. All lizards were brought into a nearby tent, where I measured coloration on various parts of their body using a spectrophotometer and then photographed their backs, sides, and stomachs. Naturally, the lizards continuously attempted to escape by squirming, biting, and defecating; however, when I placed them on their backs, gently holding them down for two to five seconds in order to photograph their bellies, the lizards went limp, relaxing their limbs, head, and tail, curling their toes, and in many cases continued to defecate. Further, some lizards would arch their heads back, leaving their mouth slightly agape. Lizards initiated this behavior only after several seconds of being overpowered and while I quantified this behavior by placing lizards on their back, many lizards also initiated this defense strategy when they were overpowered right-side-up. Of the 96 lizards photographed, 74 initiated thanatosis when they were first held on their backs. The remaining 22 lizards displayed this behavior on the second or third try. Once limp, clapping my hands close to the lizards did not elicit any reaction. In fact, the only movement I observed during this behavior was their breathing and defecating. Once thanatosis initiated, 84 lizards remained in this position until I walked ca. 2 m away, at which time the majority of them promptly turned over and tried to escape. 41 of these 84 lizards remained in thanatosis for over two minutes, and in three cases, lizards remained on their backs for an excess of five minutes, turning over only when I gently poked their belly with my index finger. The remaining 12 lizards remained limp on their backs for 20 seconds or less, trying to escape before I walked away from them.

Although the adaptive significance of this behavior is not investigated here, presumably this behavior is an anti-predatory adaptation intended to confuse predators that have managed to catch a lizard (Gehlbach 1970, *op. cit.*; Pasteur 1982. Ann. Rev. Ecol. Syst. 13:169–199). This is a risky strategy, as lacertid lizard bellies are one of the softest parts of their body (pers. obs.); however, from my observations, it is a strategy that they adopt only after being overpowered—perhaps a strategy of last resort.

Patterns of thanatosis in other taxa suggest that individuals who exhibit death-feigning behavior maximize their probability of survival even after being captured. For example, Sargent and Eberhardt (1975, *op. cit.*) found that ducks who feigned death in response to being captured by red foxes increased the likelihood of their survival when compared with ducks that did not feign death because staying still seemed to minimize further attacks. It seems reasonable that death feigning in lizards could similarly affect their predators and increase the likelihood of a lizard's survival after capture. By going limp, a lizard might convince a predator that it is dead and, as a result be left alone long enough to escape. In conjunction with the visual immobility tactic, I observed that most of the lizards defecated before or during their death feigning response. Various other animals combine visual and olfactory cues to deter predators. For example, Doody et al. (1996. Herpetol. Rev. 27:82–83) found that the Mud Snake (*Farancia abacura*) defecates during or just before playing dead. Using both strategies together might maximize an individual's likelihood of survival.

It is well known among experienced herpetologists and pet keepers that many lizards seem to relax when they are turned on their backs. This behavior, referred to as tonic immobility or animal hypnosis, is characterized by a state of intense unresponsiveness and apparent temporary paralysis produced by a form of physical restraint (Gallup 1973, op. cit.). However, I believe that the death-feigning behavior exhibited by *P. pityusensis* is distinct from this commonly observed "relaxing" behavior. First, as defecation is an anti-predatory behavior used across many taxa, its employment in conjunction with putative death-feigning suggests that the strategy displayed in *P. pityusensis* is in fact an anti-predatory behavior. Additionally, the lizards in this study seemed to gather environmental cues to determine the duration with which they remained immobile. The duration of thanatosis in *P. pityusensis* was affected by how close I was to the lizards. As I moved farther away, lizards were more likely to terminate death-feigning and attempted to escape. Similar reports have been described of the recovery time from immobility in juvenile Eastern Hognose Snakes (*Heterodon platirhinos;* Burghardt and Greene 1988. Anim. Behav. 36:1842–1844) and the Green Anole (*Anolis carolinensis*; Gallup 1973, *op. cit.*). Finally, some lizards arched their heads back and opened their mouth during this behavior. Snakes that display thanatosis, such as *H. platirhinos*, also lie on their backs with their mouth open (Burghardt and Greene 1988, *op. cit.*). Although *P. pityusensis* do not leave their tongues protruding like snakes do, this open mouth display has not been described in other lizards that that exhibit tonic immobility. Together, these observations strongly suggest that the visual immobility displayed by *P. pityusensis* should be categorized as thanatosis, making this one of the first documented cases of lizards employing this behavior.

This may be a strategy common in other, closely related lizards (Gallup 1973, *op. cit.*). Future research should investigate the presence of this behavior in related lizard species and interperet its adaptive significance. Predator diversity among different populations living on various islands within this chain has not been quantified, however, differences in predation pressure is suggested in the striking color variation observed among populations of *P. pityusensis* with cryptic lizards representing some populations and conspicuously colored in others (Cirer and Martinez-Rica 1990, *op. cit.*; Dappen, unpubl. data). Moreover, predator regimes have been found to vary dramatically among Northern Balearic Islands, and these differences have affected other aspects of anti-predatory behavior in lizard populations such as the employment of caudal autonomy, or the minimum distance to which these lizards will allow potential predators to approach them before es-

caping (Pafilis et al. 2007. Naturwissenschaften 7:320–325). As I observed variation in both the initiation and duration of thanatosis in *P. pityusensis*, a logical next step would be to investigate the employment of this behavior among populations of lizards that are exposed to varying degrees of predation pressure.

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