Nocturnal activity in a Serbian population of *Podarcis muralis* (Laurenti, 1768)

Lizards exhibit a wide variety of activity patterns resulting from the interaction between their internal rhythms and the cyclic processes in the environment (Underwood 1992). Regarding diel activity, even if some taxa (i.e. Gekkota) switched to a crepuscular life, most species are day active (Underwood 1992). Such diurnal patterns, nevertheless, may be altered either by unusually warm temperatures or by the presence of night light of anthropogenic origin, known as light pollution. Under these conditions, some diurnal species were reported to extend their activity into the night when located close to artificial lights (Perry & Fisher 2006; Perry et al. 2008).

Lacertids are among the strictly diurnal lizards, using heliothermia as the main thermoregulatory strategy (Avery 1982). Certainly, their activity patterns may change depending on external factors such as environmental temperatures and photoperiod, and internal factors such as the particular species involved, its reproductive state and developmental stage (Foà et al. 1992, 1994). However, lizards' circadian cycles persist even when the animals are exposed to artificial light conditions in the laboratory, revealing endogenous rhythms (Marx & Kayser 1949; Constantinou & Cloudsley-Thomson 1985; Molina-Borja et al. 1986; Bertolucci et al. 1999). Nevertheless, isolated but repeated instances of crepuscular and nocturnal activity were observed in *Timon lepidus* (Daudin, 1802) (Valverde 1967; Franco et al. 1980; Hódar et al. 1996) and *Gallotia* sp. (Böhme et al. 1985; Molina-Borja pers. comm.). Here, we report another apparent exception to the rule of strict diurnal activity in lacertids.

During herpetological field studies in Serbia, nocturnal observations were conducted at Kalemegdan Castle, located within the city of Belgrade (44.822110 N, 20.448127 E; altitude 97 m a.s.l.) on 3 September 2011. The night was extremely warm for the date (26ºC air temperature recorded *in situ* by a street thermometer, located 400 m NW of the study site and accessed under http://weatherspark.com/) with no wind. Similar conditions prevailed several days before and after this day (24-26ºC in the period 22:00-00:00 h, local time; http:// weatherspark.com/). Temperatures could not be recorded *ad hoc* due to the lack of proper equipment during the observations. Given these favorable ambient conditions, a searching transect of approximately 500 m was set along the eastern walls of the castle. The walls, built on large calcareous blocks covered by scarce herbaceous vegetation, were illuminated by powerful light reflectors of approximately 2 kW each. This transect was monitored by four observers for encounters of lizards between 22:00 and 22:30 (local time) in a north-south direction, and between 23:00 and 00:00 in the opposite way, when no other light than that from the reflectors was available. No further transects were inspected in the subsequent nights.

Although the initial targets of the studies were geckos, eventually introduced to Belgrade, unexpectedly, all resulting observations corresponded to the lacertid *Podarcis muralis* (Laurenti, 1768). A total of 25 lizards were seen in the first transect pass and 11 in the second. Both adult (14 males and 13 females) and immature (9) individuals were involved in behaviors reaching from basking posture in front of a reflector to active foraging (images available from the authors) and escaping into crevices or up to the non-illuminated wall top. Several individuals were observed at a close mutual distance, and, at least one, an adult male, was observed capturing and eating a crane fly (Diptera: Tipulidae) attracted by a reflector.

Podarcis wall lizards, and *P. muralis* in particular, are well known to occupy urban habitats (Capula et al. 1993; Gherghel et al. 2009), including those in Serbia (Lazić et al., submitted). Moreover, active *P. muralis* are frequently present at suboptimal thermal conditions (Rugiero 1995). In fact, the environmental temperatures during the observations did not greatly differ from daytime temperatures under which this species is active in fall (Grbac & Bauwens 2001). Although body temperatures were not recorded, they should have been higher

in the vicinity of the reflectors and, hence, may have been sufficient for foraging (AVERY 1978). On the other hand, the abundant insects attracted by lights constitute an additional food resource in a dry period and may compensate for the disadvantages of increasing predatory risk and decreasing foraging success due to darkness (PERRY & FISHER 2006; PERRY et al. 2008). The alternative explanation of lighting disturbance of lizards inside their nocturnal refuges due to the reflectors can be discarded since stone walls had multiple deep crevices (>1 m) remaining in complete darkness. Nevertheless, it is remarkable that only one more similar case has been mentioned (HENLE 1980, for coastal Croatia), whereas none of the authors of this note had similar observations after years of research with *Podarcis* sp. in warm, urban areas. It is also noteworthy that the nocturnal activity was displayed by a substantial part of the population and not limited to isolated individuals. Further research should be addressed to systematically monitor the activity of *Podarcis* populations under natural and artificial light and temperature regimes in the wild in order to provide evidence on the eventual synergic effects of global climate change and additionnally, light pollution. Furthermore, manipulative experiments (INNOCENTI et al. 1994; MINUTINI et al. 1995; PASQUALETTI et al. 2003) should be conducted to determine whether adaptive phenomena are taking place (ANGILLETTA 2009; ANGILLETTA et al. 2009).

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