Graham-
Here's to our favorite
"alien" species! Best wishes.
John

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The Introduction of European and Italian Wall Lizards (*Podarcis muralis* and *P. sicula*; Reptilia, Lacertidae) into the United States

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ABSTRACT

Several populations of lacertid lizards were introduced to the United States during the last century. Of these, the European wall lizard (*Podarcis muralis*) in Cincinnati, Ohio, and northern Kentucky and the Italian wall lizard (*Podarcis sicula*) on Long Island, New York, and in Topeka, Kansas, have become well established. These urban populations are successful in that they have little competition from native species and are pre-adapted for the climate at these latitudes. Local scientists are taking advantage of the opportunity to study the natural history and population ecology of these populations.

INTRODUCTION

One of the most successful invasive groups of Old World reptiles found in the United States is from the family Lacertidae. Conant and Collins (1998) reported five possible extant populations of two lacertid lizard species in the eastern U.S. The first introduction of wall lizards was an accidental escape of several individuals of *Podarcis sicula* from an animal dealer in Philadelphia in 1927 (Kauffeld 1931); this population may now be extinct (Smith and Kohler 1977). A small population of *P. sicula* was established in Topeka, Kansas, from a similar loss of specimens by a pet dealer about 50 years ago (Collins 1982). A third population of this species was introduced to Long Island, New York, in 1966 (Gossweiler 1975).

A record of *Podarcis muralis* from Van Wert, Ohio, reported by Conant and Collins (1998) has recently been determined to be *Darevskia valentini* by Bischoff and Deichsel (2002) and was likely only a single specimen included in a shipment to an equipment company. No known population of *D. valentini* exists in the U.S. However, a successful introduction of *P. muralis* has occurred in Cincinnati, Ohio (Vigel 1977). A review of the systematics and natural history of the species can be found in Gruschwitz and Bohme (1986). When I first moved to the Cincinnati area in 1977, it was the local naturalist and nature cinematographer Karl Maslowski who told me the interesting story of the amazing "Lazarus Lizards" of Cincinnati (Maslowski and Maslowski 1979).

THE *PODARCIS MURALIS* INTRODUCTION

The confusion about the original introduction of *Podarcis muralis* in Cincinnati was clarified in a recent paper by Deichsel and Gist (2001). Based on this report, it now appears that 10 individuals were released, rather than the previously thought number of two (Vigle 1977). George Rau, a member of the locally well-known Lazarus family, released the lizards on Torrence Court in eastern Cincinnati when he was a child in 1951 or 1952 (Deichsel and Gist 2001). The source of these lizards of the subspecies *P. muralis muralis* was near Lake Garda, about 120 km away from Milan, Italy (Deichsel and Gist 2001).

In 1958, Rau claims to have also introduced 10 additional lacertid lizards at the same location from the island of Vedra off Ibiza, Spain, which were likely *Podarcis pityusensis vedrae* (Deichsel and Gist 2001). Deichsel and Gist (2001) pointed out that there is no evidence that this introduction was successful, which is likely due to its coming from a warm maritime climate where it does not need to enter dormancy in winter. On the other hand, Hedeen (1984) pointed out that the annual precipitation and temperature curve for Milan, Italy, and Cincinnati, Ohio, are almost identical, indicating that *P. muralis* was pre-adapted to its new home. Both Lake Como (the site of origin reported by Vigle 1977) and Lake Garda (the site of origin reported by Deichsel and Gist 2001) are near Milan in Lombardy Province in northern Italy (Hopkins 1997).

SUBSEQUENT DISPERSAL

In the original report in the literature of *Podarcis muralis* in Cincinnati, Vigle (1977) mentioned that the populations had spread to an oval-shaped distribution of about 1 × 3 km surrounding the reported site of release. He reported that they had dispersed over roads that were heavily traveled. Hedeen (1988) found that a second population was established at the Cincinnati Zoo and Botanical Garden by individuals that had escaped from an exhibit at the Children's Zoo. This extended the population about 4 km to the northwest of the original one. About that same time I confirmed reports from S.F. Platek (pers. comm.) that *P. muralis* spread up the floodplain and across the Little Miami River to the northeast from the original introduction. As Kauffeld (1931) speculated for *P. sicula* in Philadelphia, Hedeen and Hedeen (1999) reported that railroad rights-of-way have been a major avenue for the east-west dispersal of the original population.

The first anecdotal report of *Podarcis muralis* having crossed the Ohio River into northern Kentucky came from a high school teacher in Covington in 1988. Extensive searching of the area near Scott Boulevard and Twentieth Street by the author and Matthew Draud yielded no sightings. Other stories of young fishermen crossing the bridges and bringing wall lizards back to use as bait circulated in the herpetological community. It was not until September 1993, however, that the first documented state record of the species was made in Fort Thomas, Campbell County, Kentucky (Draud and Ferner 1994). Soon after that, G. Pille (pers. comm.) reported the release of several *P. muralis* captured from the Cincinnati population into gardens in Park Hills, Kenton County, Kentucky, which were immediately confirmed as an established, reproducing population (Ferner and Ferner 2002). Both these Kentucky populations have spread in a radius of about 0.5 km around the residential neighborhoods in which they were introduced.

RESEARCH ON THE INTRODUCED POPULATIONS

Introduced species provide research opportunities relative to both their basic biology as well as their process of colonization. *Podarcis muralis* from the Cincinnati population has had aspects of its natural history such as home range (Brown et al. 1995), reproductive cycle (Kwiat and Gist 1987), and freezing tolerance (Claussen et al. 1989) studied in detail. The food habits of the Long Island population of *P. sicula* have been found to be very similar to some European populations (Burke and Mercurio 2002). Burke and Ner (2004) reported the seasonal and diel activity of this species in New York to be impacted by the lower minimum temperatures than found in Italy. They found the wall lizards are inactive for 5 months over the winter in the U.S., as compared to at least some activity throughout the year in the Italian populations.

An additional area of inquiry of great interest with introduced populations is their genetic make up relative to such questions as genetic drift and selective pressures. Loss of variability is expected with introduced species because of their initial small gene pool (Gorman et al. 1978). Deichsel and Gist (2001) reported on unpublished data by R.M. Brown that indicates an absence of allozyme variation at 14 allozyme loci in the Cincinnati population of *Podarcis muralis*, which is now thought to have been established by the introduction of just 10 individuals. Further genetic studies of these spreading populations will be of interest.

THE FUTURE OF THE INTRODUCED POPULATIONS

While many intentional or accidental introductions of invasive species may not be suc-

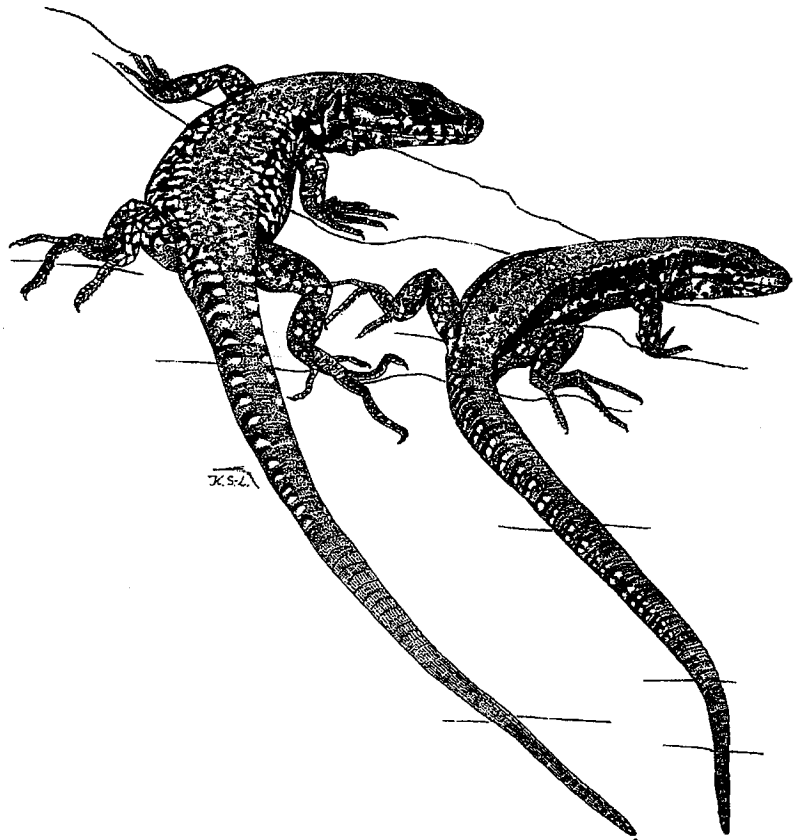

Figure 1. European wall lizards (*Podarcis muralis*). The larger female on the left has a regenerated tail as compared to the male on the right. Artwork by Katharina Schmidt-Loske.

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Corrected: Dr Deichsel

cessful, those that become established warrant our concern. Three populations of *Podarcis* seem to be so well established that their long-term survival is likely. While there were some reports that the Philadelphia *P. sicula* had died out in the 1940s, Conant (1959) found them to be doing well in the original location as they may be to this day (Conant and Collins 1998). Brown et al. (1995) reported a decline of *P. muralis* in some neighborhoods in Cincinnati due to real estate development and restoration of retaining walls. However, my observations confirm that these are only very localized setbacks and overall the lizard populations remain vigorous and are continuing to disperse.

Another concern with introduced species is what impact they will have on other native or introduced species in the region (Frankenberg 1984; Salzburg 1984). Hedeen (pers. comm.) and I have not yet found sympatry between *Podarcis muralis* and the three native species in the Cincinnati and northern Kentucky region. These three species are *Sceloporus undulatus, Eumeces* fasciatus, and *E. laticeps*, with *S. undulatus* near the northern limit of its range and *E. fasciatus* having no confirmed records in northern Kentucky (Conant and Collins 1998). While old museum records of these species can be found in the vicinity where the wall lizards now roam, recent sightings of the native species in urbanized areas are lacking. *Podarcis muralis* is known to be an aggressive competitor and well adapted for urban environments (Deichsel and Gist 2001); it appears that the wall lizards have no competition from native species.

What would happen if *Podarcis muralis* moves from urban areas into more natural habitats such as those in California Woods City Park in Cincinnati or Devou Park in Covington, Kentucky? Wall lizards have dispersed to the edges of many such habitats where some native species may still remain. Based on a foraging mode using olfactory cues, these lacertids (Cooper 1995) seem more similar to the skinks than to the iguanid lizards. While relying heavily on olfaction, wall lizards also respond well to visual cues and therefore may be a very broad-based competitor (Amo et al. 2004). Mesocosm experiments similar to those done by Tiebout and Anderson (2001) are currently being done by students at Thomas More College to determine the potential for niche overlap should the alien wall lizards move into the range of the native lizards in the Cincinnati region.

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