8th International Symposium on the Lacertids of the Mediterranean Basin

Koper, 3rd-6th June 2013

društvo za preučevanje dvoživk in plazilcev
societas herpetologica slovenica

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ABOUT

This is a booklet issued on the occasion of the **8th Symposium on the Lacertids of the Mediterranean Basin** that is held in Koper, on the Slovenian coast side in June 2013.

The main aim of these Symposia is to bring together herpetologists from all around the world who are active on the field of the study of Lacertids. The relaxed and friendly atmosphere of these congresses provides an excellent opportunity to hear the latest developments in various fields of Herpetology, to share research experience and expertise, and to develop new and closer contacts with colleagues from different countries.

Following the success of previous symposia in Lesvos (1992), Faro (1995), Cres (1999), Menorca (2001), Lipari (2004), Lesvos (2008) and Palma de Mallorca (2010), Slovenian coast is proud to be the host to this exciting event. The scientific program of this years' symposium includes three invited speakers from prominent researchers, 26 oral communications and one poster session covering most up-to-date findings and studies done with Lacertids.

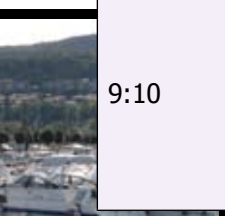
We hope that as organizers, Societas herpetologica slovenica - society for the study of amphibians and reptiles and The Faculty of Mathematics, Natural Sciences and Information Technologies of University of Primorska, we will successfully organise this event in the beautiful coastal city of Koper at the north of the Adriatic sea.

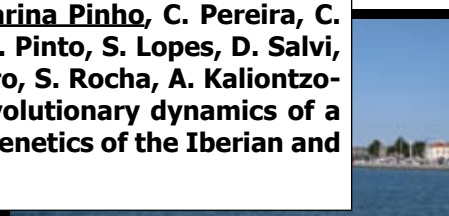


SCIENTIFIC PROGRAMME

3th June	MONDAY
11:00 - 13:30	**Registration (+ free time for lunch)**
13:30 - 13:50	Opening of the symposium
	SESSION 1. Ecology and Climate change
	chair: Miguel A. Carretero, Michael J. Angiletta
13:50	**Plenary lecture P1. Michael J. Angilletta Jr.: Are Mediterranean lizards safe from climate change?**
14:50-15:20	**Coffee Break 1**
	SESSION 1. (continued)
	chair: Miguel A. Carretero, Michael J. Angiletta
15:20	**O1.** M. Mangiacotti, L. Bassu, V. Nulchis, R. Sacchi, S. Scali, C. Corti: Disentangling the effects of anthropogenic and climatic factors on the distributions of two insular lizards
15:40	**O2.** A. Grimm, K. Henle: Trait database of reptile life histories
16:00	**O3.** Y. Itescu, S. Meiri: Environmental conditions affect body condition of Israeli lacertids
16:20 - 16:40	**O4.** S. Baškiera, D. Jelić: A comparative analysis of reproductive traits in viviparous and ovoviviparous populations of *Zootoca vivipara* (Von Jacquin, 1787)
17:00 - 19:00	**Reception/Welcome party**

4th June	TUESDAY
	SESSION 2. Evolutionary Biology and Phylogeography
	chair: Catarina Pinho, Elena Varljen Bužan
9:10	**Plenary lecture P2. Catarina Pinho, C. Pereira, C. Luis, A. Couto, D. Costa, C. Pinto, S. Lopes, D. Salvi, D. J. Harris, M. A. Carretero, S. Rocha, A. Kaliontzopoulou: Unraveling the evolutionary dynamics of a cryptic species complex: genetics of the Iberian and North African wall lizards**





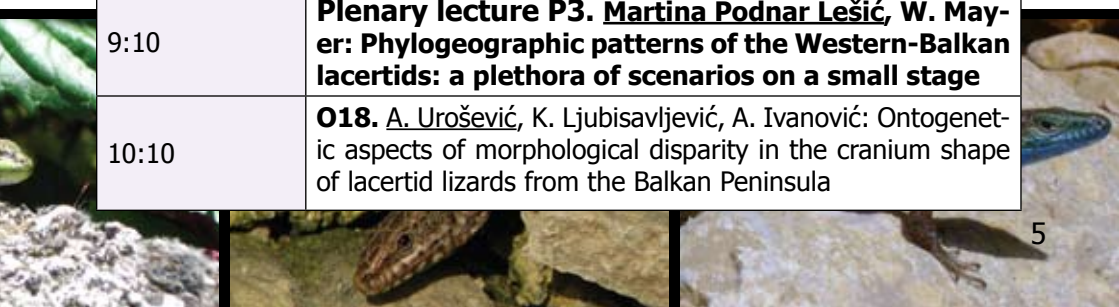
10:10	**O5**. F. Ahmadzadeh, M. Flecks, M. A. Carretero, O. Mozaffari, W. Böhme, D. J. Harris, S. Freitas, D. Rödder: Cryptic speciation patterns in Iranian rock lizards uncovered by integrative taxonomy
10:30	**O6.** E. Marzahn, W. Mayer, H. Stuckas, A. Žagar, V. Cafuta, U. Fritz: Who am I? The green lizards of Slovenia (*Lacerta viridis complex*)
10:50-11:20	**Coffee Break 2**
	SESSION 2. (continued)
	chair: Catarina Pinho, Elena Varljen Bužan
11:20	**O7.** S. Meiri, P. Pafilis: Character release and enhanced sexual dimorphism? Maybe, but not in insular *Podarcis*
11:40	**O8.** F. Ahmadzadeh, M. Flecks, D. Rödder, W. Böhme, C. Ilgaz, D. J. Harris, J. O. Engler, N. Üzüm, M. A. Carretero: Multiple dispersal out of Anatolia: biogeography and evolution of oriental green lizards
12:00	**O9.** F. Ahmadzadeh, M. Flecks, M. A. Carretero, W. Böhme, C. Ilgaz, J O. Engler, D. J. Harris, N., Üzüm, D. Rödder: Rapid lizard radiation lacking niche conservatism: ecological diversification within a complex landscape
12:20	**O10.** G. While, T. Uller, R. Heathcote: Sexual selection and the evolutionary implications of multiple introductions in an invasive lizard
12:40 - 14:40	**Lunch Break**
	SESSION 2. (continued)
	chairperson: Jelka Crnobrnja-Isailović, Irena Grbac
14:40	**O11.** A. Kaliontzopoulou, D. C. Adams, M. A. Carretero: Habitat use and sexual dimorphism in *Podarcis* wall lizards: micro- and macroevolutionary patterns of morphological variation
15:00	**O12.** D. Salvi, D. J. Harris, A. Kaliontzopoulou, M. A. Carretero, C. Pinho: Range-wide phylogeography of the common wall lizard *Podarcis muralis* reveals persistence across Pleistocene Ice Ages in Mediterranean and extra-Mediterranean refugia
15:20 - 16:00	**Poster session 1**



15:30 - 16:00	**Coffee Break 3**
	SESSION 2. (continued) and SESSION 3. Ecology and Behaviour
	chair: Jelka Crnobrnja-Isailović, Irena Grbac
16:00	**O13.** T. Uller, G. M. While, S. Michaelides: Mediterranean Invaders: Origin and Genetic Diversity of the Common Wall Lizard in England
16:20	**O14.** K. Tamar, S. Carranza, J. Moravec, R. Sindaco, S. Trape, S. Meiri: Preliminary phylogenetic relationships of the genus *Acanthodactylus* Wiegmann, 1834
17:00	**O15.** E. García-Muñoz, A. Cortada, B. Mesquita, M. A. Carretero: Brain lateralization in lizard: the game of escape behavior at different hierarchical levels
17:20	**O16.** M. A. Carretero, E. Argaña, R. Duarte: How plastic is antipredator behaviour in lacertids? Comparing two populations of *Podarcis carbonelli* with different levels of human disturbance
17:40 - 18:00	**O17.** A. Žagar, M. A. Carretero, A. Vrezec: Escape and recovery tactics of two syntopic and morphologically similar lacertid lizards
20:00 - xx	**Symposium dinner**

5th June	**WEDNESDAY**
10:30 - 19:00	**Bus transfer from symposium place to the field trip**

6th June	**THURSDAY**
	SESSION 4. Morphology and Ecology
	chair: Clauda Corti, Martina Podnar
9:10	**Plenary lecture P3. Martina Podnar Lešić, W. Mayer: Phylogeographic patterns of the Western-Balkan lacertids: a plethora of scenarios on a small stage**
10:10	**O18.** A. Urošević, K. Ljubisavljević, A. Ivanović: Ontogenetic aspects of morphological disparity in the cranium shape of lacertid lizards from the Balkan Peninsula



10:30	**O19.** R. Sacchi, M. Mangiacotti, S. Scali, M. Sannolo, D. Pellitteri-Rosa, A. Bellati, P. Galeotti, M. Fasola, M. A. L. Zuffi: Condition dependent sexual dimorphism in the common wall lizard: a geometric morphometric study in the Tuscan Archipelago
10:50-11:20	**Coffee Break 4**
	SESSION 4. (continued)
	chair: Clauda Corti, Martina Podnar
11:10	**O20.** S. Zotos, C. Adamopoulou, V. Chondropoulos, C. Kadis, A. Legakis: Morphometric characteristics and age-depended colour changes in *Acanthodactylus schreiberi* (Sauria: Lacertidae) from a sand-dune ecosystem in Cyprus
11:30	**O21.** M. Lazić, A. Kaliontzopoulou, M. A. Carretero, J. Crnobrnja-Isailović: Fluctuating asymmetry in urban vs. rural populations of *Podarcis muralis*
11:50	**O22.** M. A. L. Zuffi, F. Messina, C. Giannelli, O. Lanzoni, F. D. Nardi: Sexual Size Dimorphism in the Italian Wall Lizard: Do Size and Age Influence Color Patterns?
12:10	**O23.** M. Lazić, J. Crnobrnja-Isailović: Influence of vegetation cover on tail break frequencies in *Podarcis muralis*
12:30 - 14:10	**Lunch Break**
	SESSION 5. Physiology and Ecology
	chair: Panayotis Pafilis, Martina Lužnik
14:10	**O24.** M- Sannolo, M. Mangiacotti, R. Sacchi, S. Scali: Head-body temperature difference in *Podarcis muralis*: experimental evidence
14:30	**O25.** J. Vukašin Čorović, J. Crnobrnja-Isailović: Aspects of thermal ecology of meadow lizard (*Darevskia praticola*)
14:50	**O26.** S. Baeckens, K. Huyghe, S. Edwards, R. Van Damme: The role of chemical communication in lacertid lizards - PhD prospects and goals
15:10	**Closing session**

PLENARY SPEAKERS

P1.
Are Mediterranean lizards safe from climate change?

Angilletta Jr., Michael J.[1]

[1]Arizona State University, USA

Human activities have triggered unprecedented changes in Earth's climate, generating many concerns about the future of biodiversity. Although temperate regions are warming more rapidly than tropical ones, the heightened sensitivity of tropical species could make them more vulnerable to climate change. Indeed, recent analyses indicated that temperate and subtropical lizards, such as those throughout the Mediterranean region face little risk of extinction in the coming decades. Yet, these analyses involve simplifying assumptions that are patently false for lizards. Relaxing those assumptions leads to a more complex view: the risk of extinction should vary among species within regions, given the capacity for behavioral thermoregulation and physiological acclimation. Detailed models of population dynamics in predicted thermal landscapes can help to identify which species face the greatest risks. I will illustrate this approach using data for a North America species of lizards, *Sceloporus undulatus*.

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P2.
Unravelling the evolutionary dynamics of a cryptic species complex: genetics of the Iberian and North African wall lizards

Pinho, Catarina[1]; Pereira, Carolina[1]; Luís, Carla[1]; Couto, Alvarina[1]; Costa, Diogo[1]; Pinto, Catarina[1]; Lopes, Susana[1]; Salvi, Daniele[1]; Harris, D. James[1]; Carretero, Miguel A.[1]; Rocha, Sara[1]; Kaliontzopoulou, Antigoni[1]

[1]CIBIO/UP, Centro de Investigação em Biodiversidade e Recursos Genéticos da Universidade do Porto, Vairão, Portugal

Wall lizards (*Podarcis* spp.) from the Iberian Peninsula and North Africa have long been acknowledged as a case of doubtful taxonomy. The application of genetics to study evolutionary dynamics in this group of organisms showed that it is formed by several divergent lineages, a finding which set the basis for the on-going taxonomic re-evaluation of the group. In this talk I will review over a decade of studies on the evolutionary genetics of these organisms, with particular emphasis on species delimitation and speciation dynamics. I will also address recent findings regarding the nature of gene flow between species of this group and the multilocus phylogeny of the clade. Overall the results show that the taxa that compose this clade are closely-related yet well-defined species and that gene flow has repeatedly played a major role in shaping the evolutionary patterns of this clade, although with different impacts of different species pairs. I will finish by describing current and future research avenues, which will hopefully set *Podarcis* as one of the most important reptilian models for the study of speciation.

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P3.
Phylogeographic patterns of the Western-Balkan lacertids: a plethora of scenarios on a small stage

Podnar, Martina[1]; Mayer, Werner[2]

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[2]Molecular Systematics, 1st Zoological department, Natural History Museum, Vienna, Austria

At the western side of Dinarides-Hellenides mountain chain 12 species of lacertid lizards occur. All hitherto investigated species appeared to be phylogeographically highly structured. Their present phylogeographic patterns are the result of the complex topography and the geotectonic history of the region, multiple events of range retractions and subsequent expansions during Pleistocene climatic oscillations but also distinct ecological preferences of the species, interspecific competition, overwater dispersals and unintentional anthropogenic introductions. The phylogeography of *Podarcis siculus*, *P. melisellensis*, *P. tauricus*, *Algyroides nigropunctatus*, *Dalmatolacerta oxycephala* and *Dinarolacerta mosorensis* will be discussed in details.

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ORAL PRESENTATIONS

O1.
Disentangling the effects of anthropogenic and climatic factors on the distributions of two insular lizards

Mangiacotti, Marco[1]; Bassu, Lara[2]; Nulchis, Valeria[2]; Sacchi, Roberto[3]; Scali, Stefano[1]; Corti, Claudia[4]

[1]Museo Civico di Storia Naturale di Milano, Milano, Italy
[2]Sezione Sardegna S.H.I., Societas Herpetologica Italica, c/o ALEA, Oristano Italy
[3]DISTA - Dipartimento di Scienze della Terra e dell'Ambiente, Università di Pavia, Pavia, Italy
[4]Museo di Storia Naturale dell'Università di Firenze, Sezione di Zoologia "La Specola", Florence, Italy

The geographic distribution of a species is the result of many factors, among which the anthropogenic habitat alteration has become more and more important. A direct evaluation of its effect may become critical for conservation policy, particularly in insular context, where resources and animal dispersal are limited. In the present study we used species distribution models (SDM) to assess the influence of habitat alteration on the Sardinian distributions of the Tyrrhenian wall lizards (*Podarcis tiliguerta* - endemic) and the Italian wall lizard (*P. siculus* - introduced in historical or protohistorical time). SDM were built using Maxent under three scenarios: the distribution is guided i) only by climate and topography (model CT); ii) only by anthropization (An); iii) by both factors (AnCT). Sensitivity and specificity of the models was computed after applying a threshold to the Maxent output, while the Akaike Information Criterion (AIC) was used to identify the best model. Finally, a variation partitioning approach was used to disentangle the contribution of each factor. For both species, AnCT model showed the best performance (best AIC, best sensitivity and specificity). Anthropization weighs as much as climate and topography for the endemic wall lizard, whereas the weight is far lower for *P. siculus*. Climate and anthropization showed interaction in *P. tiliguerta*, whereas they are independent in *P. siculus*. Our results show that: i) the endemic lizard is more vulnerable to human impact than the non-endemic one; ii) the tolerance of *P. tiliguerta* towards anthropization varies with the climatic suitability, while it appears constant for *P. siculus*. These conclusions focus the attention on the potentially problematic situation of *P. tiliguerta*, situation that may be worsened by the suspected competition between the two species: where habitat alteration is increasing, competition may be exacerbated, favouring the Italian wall lizard and penalizing the Tyrrhenian wall lizard.

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O2.
Trait database of reptile life histories

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Many analyses of reptile ecology require knowledge of specific life-history traits. However, a comparison between different species is rare and the access to a huge amount of data is limited. Therefore, we are collecting data of all European reptile species from different sources and published in different languages. Our main focus is phenology (hibernation, aestivation, activity, breeding period etc.) separated by country of observation as well as dispersal and movement data. Our relational database will provide a sufficient basis for reptile ecology analyses and comparisons between species and countries. Searches by species and countries as well as different phenological and dispersal traits or references used for comparisons will be possible. As an example, we are using the data for a climate change modeling approach to account for the fact that species traits might affect species' ability to adapt to a changing environment. The open access database will be available online by the end of the year on www.scales-project.net.

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O3.
Environmental conditions affect body condition of Israeli lacertids

Itescu, Yuval[1]; Meiri, Shai[1]

[1]Department of Zoology, Tel Aviv University, Tel Aviv, Israel

Body condition of animals has an important effect on their fitness. An individual in good body condition has better chances of survival and reproduction than an animal with poor body condition. A commonly used measure for assessing body condition is the residuals of a regression of the body mass of an animal against its body size. The larger the residual, the better the condition of the animal is. Body mass may reflect the reproductive or nutritional state of an individual. It can be affected by biotic interactions. Predation pressure, for example, may limit foraging time. Cold climate or little rainfall may also limit foraging possibilities. Only a few studies addressed the geographic determinants of body condition in ectotherms. We tested the effects of climate and topography on body condition of lacertid lizards in Israel and the adjacent Sinai Desert (Egypt). This region shows a

sharp north to south gradient of temperatures and precipitation, as well as considerable topographic variability, which also affects climate. We tested the effects of mean annual temperature, mean annual precipitation, net primary productivity (NPP) and altitude on lacertid body condition. We collected field and museum data for 1400 specimens, representing 13 species in four lacertid genera. Our results suggest that the body condition is better in hot, dry and low elevation areas. The effect of resource availability (represented by NPP rates) was non-significant. We suggest that these conditions allow lower energetic cost for activity, and more foraging time. These result in higher energetic reserves and thus a higher body mass for a given length.

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O4.
A comparative analysis of reproductive traits in viviparous and oviparous populations of *Zootoca vivipara* (Von Jacquin, 1787)

Baškiera, Senka[1]; Jelić, Dušan[1]

[1]Croatian Institute for Biodiversity, Croatian herpetological society – Hyla, Croatia

Viviparous lizard, *Zootoca vivipara* (Von Jacquin, 1787), is the only lacertid lizard which is known to have two modes of reproduction. We studied two populations of viviparous lizard: one high mountain population from Mountain Vlašić, Bosnia and Herzegovina and another from lowlands in Spačva, Croatia. Viviparous females from Vlašić (BIH) were collected on grassland on 1800 to 1900 m a.s.l. and are considered to be *Zootoca vivipara vivipara* (Von Jacquin, 1787), while oviparous females, collected in floodplain forests of Spačva (80 to 90 m a.s.l.; CRO) are considered to be *Zootoca vivipara pannonica* (Lac & Kluch, 1968). Our main goals were to collect data on reproductive traits of newly discovered oviparous population of viviparous lizard in Spačva, Croatia and comparison to nominal viviparous population. A comparative analysis of reproductive traits (e.g. clutch size, female body size, hatchling body size) of two subspecies were made and most significant difference was in egg incubation period. In oviparous population egg incubation period was 19 to 22 days, while comparatively in viviparous population it lasted only about 30 minutes. Total body length was larger in viviparous females, as expected, as well as the clutch size in oviparous females. Some of the reproductive traits did not result in expected correlation, possibly due to small sample size.

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O5.
Cryptic speciation patterns in Iranian rock lizards uncovered by integrative taxonomy

Ahmadzadeh, Faraham[1,2]; Flecks, Morris[2]; Carretero, Miguel A.[3]; Mozaffari, Omid[4]; Böhme, Wolfgang[2]; Harris, D. James[3]; Freitas, Susana[3]; Rödder, Dennis[2]

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While traditionally species recognition has been based solely on morphological differences either typological or quantitative, several newly developed methods can be used for a more objective and integrative approach on species delimitation. This may be especially relevant when dealing with cryptic species or species complexes, where high overall resemblance between species is coupled with comparatively high morphological variation within populations. Rock lizards, genus *Darevskia*, are such an example, as many of its members offer few diagnostic morphological features. Herein, we use a combination of genetic (two nuclear and two mitochondrial loci), morphological (15 morphometric, 16 meristic and four categorical characters) and ecological (eleven newly calculated spatial environmental predictors) criteria to delimit cryptic species within two species complexes, *D. chlorogaster* and *D. defilippii*, both distributed in northern Iran. Phylogenetic analyses of the molecular data confirmed the monophyly of *D. chlorogaster*, while *D. defilippii* is paraphyletic in respect to *D. steineri*. However, each of the complexes comprises several highly divergent clades, especially when compared to other congeners. We identified seven candidate species within each complex, of which three and four species are supported by Bayesian species delimitation within *D. chlorogaster* and *D. defilippii* (including *D. steineri*), respectively. Although the species within one complex lack clear diagnostic features, they can be well separated based on morphological variables when sample size is appropriate. Ecological Niche Modelling provided additional support for the identified species and niche overlaps between them are generally low, especially in the *D. defilippii* complex.

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O6.
Who am I?
The green lizards of Slovenia (*Lacerta viridis* complex)

Marzahn, Ellen[1]; Mayer, Werner[2]; Stuckas, Heiko[1]; Žagar, Anamarija[3]; Cafuta, Vesna[3]; Fritz, Uwe[1]

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[2]Natural History Museum Vienna, Vienna, Austria
[3]Societas herpetologica slovenica, Ljubljana, Slovenia

Green lizards are widespread in Slovenia. Until now little is known about their taxonomic allocation. First mitochondrial (cytochrome b) and nuclear (ß-fibrinogen-intron7) data show that three different lineages of green lizards occur in Slovenia. In addition to two lineages of eastern green lizards (*Lacerta viridis*), the existence of the so called 'Adriatic lineage' is confirmed. In immediate vicinity (Italy and island of Cres, Croatia), the western green lizard (*L. bilineata*) occurs. This raises the question of whether there is gene flow between these two species. The nuclear marker provided evidence for gene flow. These results challenge the species status of *L. bilineata* and *L. viridis*.

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O7.
Character release and enhanced sexual dimorphism? Maybe, but not in insular *Podarcis*

Meiri, Shai[1]; Pafilis, Panayiotis[2]

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[2]Section of Zoology and Marine Biology, Department of Biology, University of Athens, Athens, Greece

Islands are usually species-poor and insular animal communities likewise usually harbour fewer species than equivalent mainland communities. Intraspecific competition on islands is therefore usually weaker than it is on the mainland. Predation pressure often also decreases on islands, and some in many instances some insular organisms face no predators at all. Faced with such relaxed predation and competition pressures insular animals can evolve to exploit the wider resource spectrum than they can access in more species-rich environments. An extension of this scenario, called the "niche variation hypothesis", results in populations of depauperate communities evolving greater morphological variability. This variability is often thought to manifest itself in enhanced sexual size dimorphism, with the larger sex growing larger still, whereas individuals of the smaller sex grow smaller, so as to reduce intra-specific competition. A clear

prediction of this theory is therefore that communities with more competitors or predators will be less dimorphic. We tested this by measuring the sexual size dimorphism (SSD) of two *Podarcis* species in two Aegean archipelagos. We measured SVLs of female and male lizards across many islands and examined it against the number of other lacertid lizards, the number all lizards, and the numbers of snake species on each island. For each species (*Podarcis gaigeae*, 16 islands; *P. erhardii*, 27 islands) we also examined whether the presence, rather than the number of lacertids, lizards, and snakes, affects the degree of SSD. *Podarcis gaigeae* was, on average, more dimorphic than *P. erhardii* (males 14% longer vs. 6%). In neither species, however, was the degree of SSD affected by either the number or the presence of snakes, lacertid lizards or lizards in general. We conclude that on small islands lacking other reptiles the resource base is likely more limited as well, and thus does not allow the sexes to diverge to specialize on different-sized prey.

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O8.
Multiple dispersal out of Anatolia: biogeography and evolution of oriental green lizards

Ahmadzadeh, Faraham[1,2]; Flecks, Morris[2]; Rödder, Dennis[2]; Böhme, Wolfgang[2]; Ilgaz, Çetin[3]; Harris, D. James[4]; Engler, Jan O.[2,5]; Üzüm, Nazan[6]; Carretero, Miguel A.[4]

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The oriental green lizards of the *Lacerta trilineata* group are widely distributed in Greece, Anatolia, the eastern Mediterranean, the southern Caucasus and the Zagros mountains in Iran. We studied their phylogeography using three mitochondrial markers with comprehensive sampling from most representatives of the group. Their phylogeny and divergence times (implementing fossil-based molecular clock calibrations) were inferred using Bayesian methods, and haplotype networks were reconstructed to assess how genetic diversity and current distributional patterns were shaped. According to our phylogenetic analyses, the group constitutes a well-supported monophylum containing several distinct evolutionary lineages with high haplotype diversity. Vicariance

might explain the divergences within most lineages that have accumulated by range restriction and expansion of populations due to Quarternary climate oscillations and glacial refugia. However, niche divergence seems to be a major force promoting speciation and large scale distributional patterns between lineages were shaped earlier by multiple, independent dispersals out of Anatolia during the Pliocene and early Pleistocene. Our results also suggest that the group is in need of a taxonomical revision, as identified lineages and genetic diversity are not congruent with the currently recognised subspecies.

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O9.
Rapid lizard radiation lacking niche conservatism: ecological diversification within a complex landscape

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Diversification and rapid radiation are well documented in lacertid lizards. Niche conservatism is frequently observed among related taxa, whereby ecological niches remain mostly stable during speciation events. Here, we investigate the relationship between environmental niche divergence and phylogenetic relatedness in a widespread group of green lizards, the *Lacerta trilineata* group. A dated phylogeny based on three mitochondrial genes was contextualized using species distribution models of all genetically identified lineages in the *Lacerta trilineata* group. Based on this analysis, ancestral climatic niche occupancy was reconstructed using niche occupancy profiles. Niche divergence among lineages was quantified by computing multivariate niche overlaps. All taxa are associated with humid areas, but there is extensive variation in their climatic niche breadths and positions, which accord with the main phylogenetic split in the group. Our results suggest divergent niche evolution within subclades and convergent evolution among clades, which implies only a limited degree of niche conservatism regarding annual variations in temperature and precipitation. In contrast, niche axes – mainly reflecting precipitation patterns of the

coldest quarter – show a greater difference among clades than within clades, and therefore a higher degree of niche conservatism. Based on estimated divergence times between taxa and geological events in Anatolia, our results can be explained by fragmentation of the range of a hypothetical ancestral species, resulting in different adaptations of subclades either to humid continental climates or to more Mediterranean climates. Our study highlights deviations from classical niche conservatism theory due to significant niche shifts among sister taxa.

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O10.
Sexual selection and the evolutionary implications of multiple introductions in an invasive lizard

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Recent research suggests that multiple introductions of distinct lineages are common in invasive species. Despite this, the impact of admixture on the fitness of introduced populations, and consequently its contribution to their evolutionary potential, has received little attention. Sexual selection should be of particular importance for understanding colonisation dynamics as it is fundamental to the maintenance of genetic variation, reproductive output, and hence population growth. Furthermore, sexual selection is predicted to be highly context-dependent. For example, variance in genetic diversity resulting from admixture should strongly influence the mating strategies employed by males and females, and thus, regulate both population dynamics and accelerate (or impede) the introgression of genotypes. We have shown that human introductions of wall lizards (*Podarcis muralis*) into the UK have brought into contact several genetically and phenotypically distinct lineages. This has significant implications for mating behaviours employed by individuals. Here we show that females do not discriminate behaviourally between males of different origins despite large differences in male morphology, pheromone profiles, and behavioural dominance between clades. Nevertheless, paternity in mixed-origin semi-natural populations was highly assortative. This could be due to male mate choice or male-male competition that results in assortative paternity in the absence of male choice per se. We discuss how these results could influence the evolutionary consequences of secondary contact in the context of formation of hybrid swarms versus reinforcement and completion of speciation.

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O11.
Habitat use and sexual dimorphism in *Podarcis* wall lizards: micro- and macroevolutionary patterns of morphological variation

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Understanding how phenotypic diversity evolves is a major objective of evolutionary biology. Iberian and North African *Podarcis* are a lizard group of astonishing morphological diversity, thus providing an intriguing model system for studying the causes underlying phenotypic evolution. We examined body size and shape variation at the individual and evolutionary lineage level in relation to sexual dimorphism (SD) and habitat use, to trace the potential effects of sexual and natural selection on different morphological traits. The results obtained indicate that SD is a major source of phenotypic variation in this group, with significant effects on all examined variables at the individual level. Habitat use also explains large part of the variation observed at the individual level, but surprisingly is not associated to body size and limb length variation, as has been the case in other lizard groups. Comparative analyses of trait evolution using the most recent mtDNA phylogeny of the group indicate a significant difference between habitats in male head shape, where males of saxicolous species exhibit relatively flatter and shorter heads than ground-dwelling ones. Such variation is also reflected on macroevolutionary patterns of sexual dimorphism, which also varies across habitats, possibly indicating an interaction between sexual and natural selection. Comparison of evolutionary rates between habitats showed that male head shape has evolved about 9 times faster in saxicolous species. Remarkably, limb length was not associated to habitat use at the macroevolutionary level, contradicting predictions of the ecomorphological paradigm and previous observations on other lizard groups. Indeed, a comparison of evolutionary rates across traits demonstrated that head dimensions have evolved much faster in this group of lizards as compared to limb length. Together our results shed new light to the evolution of the remarkable morphological diversity of this lizard group.

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O12.
Range-wide phylogeography of the common wall lizard *Podarcis muralis* reveals persistence across Pleistocene Ice Ages in Mediterranean and extra-Mediterranean refugia

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We investigated the phylogeographic pattern of the widespread Western Palaearctic lizard *Podarcis muralis*, using a range-wide multilocus approach, to evaluate whether it is concordant with a recent expansion from southern glacial refugia or alternatively from a combination of Mediterranean and northern refugia. We analyzed DNA sequences of two mitochondrial (cytb and nd4) and three nuclear (acm4, mc1r, and pdc) gene fragments in individuals from 52 localities across the species range using phylogenetic and phylogeographic methods. The complex phylogeographic pattern observed, with multiple reciprocally monophyletic allo- parapatric lineages having a Pleistocene divergence, suggests a scenario of long-term isolation in multiple ice-age refugia across the species distribution range. Multiple lineages were identified within the three Mediterranean peninsulas but also outside southern peninsulas, suggesting that additional refugia in France, Northern Italy, Eastern Alps and Central Balkans allowed the long-term persistence of this species throughout the Pleistocene glaciations. This finding provides a paradigm of temperate species survival in Mediterranean and extra-Mediterranean glacial refugia, suggesting the need for a reappraisal of the role of northern refugia for glacial persistence and post-glacial assembly of temperate ecoregions.

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O13.
Mediterranean Invaders: Origin and Genetic Diversity of the Common Wall Lizard in England

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The common wall lizard (*Podarcis muralis*) has been introduced outside of its native range on many occasions. There are about 30 populations in England, spanning an introduction history of about 100 years. These populations provide opportunities to assess how introduction history and founder events shape patterns of genetic and phenotypic diversity, and the consequences thereof for

population viability. We have identified the geographic and taxonomic origin of the wall lizard populations in England, which falls into five major native lineages. The data suggest a moderate loss of genetic diversity compared to native populations, but there is no evidence that this loss of genetic variation causes inbreeding depression in introduced populations. Multiple origins are common in introduced populations and the patterns of genetic variation suggest a complex history of establishment using different native and introduced sources. These data helps to assess the importance of genetic variation and mixing of animals from different origins for establishment success in non-native lizards.

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O14.
Preliminary phylogenetic relationships of the genus *Acanthodactylus* Wiegmann, 1834

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The Old World fringe-fingered lizards of the genus *Acanthodactylus* is the most species rich genus in the Lacertidae currently constituting 41 recognized species. *Acanthodactylus* are ground dwelling, small to medium sized lizards which usually occur in a wide variety of dry habitats. They range from the Iberian Peninsula, through the Sahara and the Sahel, the Middle East, Arabian Peninsula and Cyprus to NW India. The genus is morphologically divided into 8-10 species groups; however, because of great morphological variability among species, the taxonomic status and position of some species is unclear, and the phylogeny of this group is far from resolved. We examined the phylogenetic relationships of the genus based on sequences from 290 individuals representing 36 species from all known species groups. We sequenced 2,423 bp from two mitochondrial (12S rRNA, Cytb) and three nuclear (MC1R, ACM4, c-mos) genes. Our results suggest that the genus is divided into three well-supported clades: Clade A includes 14 species as representatives of the *micropholis*, *grandis*, *blanfordi*, *cantoris*, *opheodurus* and *boskianus* species groups. Clade B includes 14 species of the *tristrami*, *erythrurus* and *pardalis* species groups, and clade C includes the eight species of the *scutellatus* species group. The phylogenetic analyses support much of the previous studies on the genus and reveal new relationships that require further examination.

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O15.
Brain lateralization in lizard: the game of escape behavior at different hierarchical levels

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Increasing evidence is demonstrating that brain lateralization is not restricted to humans, several studies from fish to primates demonstrate that their occurrence may be widespread among vertebrates. It is now widely accepted that brain lateralization provides advantages for simultaneously performing different tasks without the risk of receiving contradictory orders from both brain sides. This explanation is meaningful from an individual and neurological point of view. Namely, each eye system could be specialized in developing a specific task such as recognition of novel object, selection of refuge, social behavior, foraging and predator avoidance, among others. Thus, individual lateralization is also advantageous in terms of energy saving that could be redirected to other tasks increasing the fitness at an individual level. From an evolutionary point of view it has even been suggested that the origin of lateralization might be as early as the appearing of visually controlled predation. However, being lateralized at hierarchical levels higher (population or species level) than individuals could have negative implications, especially if predators may predict prey behavior after multiple encounters. These conflicting pressures, namely between the advantages for individuals, and the disadvantages for populations could be concealed if higher-level lateralization would arise from the combination of lateralized behaviors of individuals which are mutually dependent. In the present study, we investigate the patterns of lateralization in different populations of lizards *Podarcis* using behavioural tests, with the aim of evaluating the incidence of lateralization at different hierarchical levels. Standardised experiments allowing lizards to equally select for either right or left refuges showed that the side of escape behavior is not universal in *Podarcis* at different hierarchical levels, some individuals and populations being lateralized with a consistent bias toward the refuge on the right. By contrast, some populations showed no refuge preference, with lack of lateralization mainly arising from the dominance of individuals with no side preference rather than from a mix of right- and left-biased individuals. When specimens from all *Podarcis* populations were considered together, a pattern for right-refuge preference arose. In conclusion, although refuge selection in *Podarcis* tends to be right biased at different hierarchical levels, some populations deviated from the rule showing no refuge preference. Further studies will be needed to infer the putative environmental pressures and the phylogenetic constraints subjacent to the lateralization of antipredator strategies in lacertids.

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O16.
How plastic is antipredator behaviour in lacertids? Comparing two populations of *Podarcis carbonelli* with different levels of human disturbance

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Antipredator strategies in lacertids vary across and within species. Previous investigations have documented divergent strategies in both escape and recovery behaviour between syntopic species, between conspecific populations inhabiting different habitats and between colour morphs and size classes within the same population. Here, we evaluate the degree of plasticity in the different components of the antipredatory behaviour by comparing two conspecific populations under divergent disturbance regimes but otherwise environmentally similar. We examined the lizard responses under direct attack from a predator (simulated by the researcher) in two populations of *Podarcis carbonelli* from geographically close (1200 m) sites from Doñana National Park (SW Spain). In both cases, lizards mainly occupied wooden passes on sandy soil allowing park visitors to reach fauna observatories but, while one (El Acebuche) was heavily frequented (40,000-50,000 visitors/year) the other (Ribetehilos) was not (<500). Field experiments were carried out in both sites during days with suitable conditions within a period with optimal temperatures but out of the reproductive period (November 2010) to exclude factors other than site, sex and size class. We recorded variables describing lizard traits (sex, size class), environment (microhabitat, refuge) and behavioural responses for 128 observations (63 for El Acebuche and 65 for Ribetehilos) throughout random walking routes. Lizards from the most disturbed population (El Acebuche) were observed closer to their refuges than those from the less disturbed one (Ribetehilos), regardless their sex, size class and habitat features. While the first were also observed on hotter substrates and males in general escaped into hotter refuges, thermal environment was insufficient to explain the behavioural differences found. By contrast with previous studies comparing species or colour morphs, no variation between sites for either escape distance, recovery time or recovery distance was recovered despite the good samples sizes. Results reinforce previous claims that individual lizards may respond to different levels of disturbance in a directional way. However, they also indicate that some components of the antipredator behaviour are more plastic that others. This should be confirmed by further experimental work.

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O17.
Escape and recovery tactics of two syntopic and morphologically similar lacertid lizards

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Lacertids are preyed upon by different predators with different foraging strategies, namely, avian predators attack from above, while terrestrial predators use either approaching on open ground or active searching for prey in their hiding places. When active, lacertids are expected to employ different antipredatory behaviours, either crypsis or early predator detection (visually or chemically) followed by escape to the shelter. Syntopic populations of overall similar lacertid species are likely to share predators. However, their predator avoidance tactics might differ. Using standard techniques, we conducted a field test of the escape-recovery tactics for two morphologically and ecologically similar species: *Iberolacerta horvathi* and *Podarcis muralis*, occurring in syntopy in the Northern Dinaric region. Adults of both species intrinsically differed in their escape tactics when approached by the researcher simulating a ground predator attack. Specifically, *I. horvathi* tended to escape at greater distances and spent more time in the shelter before emerging (longer recovery time) regardless the air, surface or refuge temperatures and habitat type. These divergent antipredator strategies involving different predation risks are expected to affect coexistence of these two lizard species.

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O18.
Ontogenetic aspects of morphological disparity in the cranium shape of lacertid lizards from the Balkan Peninsula

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We used Procrustes-based geometric morphometrics to explore morphological variability in dorsal and ventral cranium shape of twelve lacertid

lizard species from the Balkan Peninsula (*Darevskia praticola*, *Dinarolacerta mosorensis*, *Iberolacerta horvathi*, *Lacerta agilis*, *L. trilineata*, *L. viridis*, *Podarcis erhardii*, *P. melisellensis*, *P. muralis*, *P. sicula*, *P. taurica* and *Zootoca vivipar*a), at the juvenile (neonatal) and at the adult stage (females and males separately). These species differed in phylogenetic relatedness, overall size and habitat preference (terrestrial in overgrown habitats, terrestrial in sparsely vegetated habitats, saxicolous and semiarboreal). General pattern of shape variation appeared to be preserved throughout ontogeny, especially for the dorsal cranium - adult female and male morphospaces corresponded to the neonate morphospace. The inspection of morphospaces showed that the general pattern of shape variability was along the gradient from the smaller to the species with larger body size. Along this gradient, species clustered according to habitat preference. The main difference between neonates and adults was the position of semiarboreal species, which completely separated from the rest of the species at the adult stage. The overall morphological disparity (MD) increased during the course of ontogeny (from neonates to adult females and males). Ventral cranium, with its structures involved in mechanics of jaw movement and feeding, showed greater increase in MD, as well as the shift in the morphospace hyperplanes. On the generic level, *Lacerta* spp. showed significantly higher MD than *Podarcis* spp. In contrast to other ecological groups (terrestrial and semiarboreal) saxicolous lizards showed a tendency of decreasing shape disparity during ontogeny. The species from saxicolous group were phylogenetically heterogeneous but morphologically convergent due to the specific habitat constraints, and their distinctive MD pattern could be achieved by different allometric paths. The patterns of shape variation and MD were modified by ecology, functional constraints and different ontogenetic trajectories. Further studies on the ecomorphology, allometric diversity and morphological integration, as well as the reassessment of the problematic lacertid phylogeny are needed in order to shed more light on the complex relationships among morphology, ecology and phylogeny in lacertid lizards.

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O19.
Condition dependent sexual dimorphism in the common wall lizard: a geometric morphometric study in the Tuscan Archipelago

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Sexual dimorphism is a widespread phenomenon among animals and is generally interpreted as the result of both natural and sexual selection. When sexual dimorphism evolves through sexual selection, theory predicts the exaggeration of male ornaments and/or armaments, and only males in better condition or with high genetic quality can sustain the costs for their expression. Sexual selection on male traits is expected to result in a condition-dependent sexual dimorphism (CDSD) if the variability of environmental factors affects the quantity and quality of metabolic resources that can be actually allocated to secondary sexual characters by males. Most evidence supporting CDSD came from insects, and few studies have been performed on vertebrates, mainly because of troubles in carrying out experiments under captivity. In this scenario, islands offer a unique opportunity to compare how the environment affects the expression of sexual dimorphism, since they represent a "natural experiment" in which different populations of the same species experience environmental constraints differing for both quality and intensity. We investigated the occurrence of CDSD in head shape of common wall lizards (*Podarcis muralis*) inhabiting the Tuscan Archipelago using a geometric morphometric approach. Our sample included 209 lizards (125 males and 84 females) from seven islands and two paleo-islands. Data consists of x and y coordinates of 32 landmarks located at the intersections of the head scales and four semi-landmarks. Shape variables were obtained through generalized procrustes superimposition, and seven alternative models were formulated accounting for as many alternative hypotheses. H0, assumes that the sexual dimorphism is uninfluenced by islands, H1, assumes the effect of only phylogeny, H2 and H3 account for the phylogeography of the Tuscan archipelago, H4 and H5 combine phylogeny and phylogeography, while H6 assumes island specific effects on sexual dimorphism. Models were compared using Akaike informative criterion adjusted for multivariate analyses. All hypotheses performed better than H0, suggesting that sexual dimorphism in common wall lizards is actually affected by phylogeny, phylogeography and local environmental conditions. However, H6 largely outperformed all other alternative hypotheses, indicating that local environmental conditions are the most relevant factor affecting the variability of sexual dimorphism of head shape. A variance partitioning analysis confirmed that sexual dimorphism actually differs among island. In conclusion our results support the hypothesis of the occurrence of CDSD in common wall lizards.

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O20.
Morphometric characteristics and age-depended colour changes in *Acanthodactylus schreiberi* (Sauria: Lacertidae) from a sand-dune ecosystem in Cyprus

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Morphometric characteristics and colour patterns were studied during a three year period (spring 2007 - spring 2010), in a population of the lacertid lizard *Acanthodactylus schreiberi schreiberi* occupying a well preserved dune ecosystem on the island of Cyprus. Data were collected from 444 individuals (150 of them were recaptured from two to eight consecutive seasons) in the field and 46 juveniles hatched in the laboratory. Based on their maturity stage and age, the studied individuals were grouped into five different age classes (two classes for subadults and three for adults). Morphometric characteristics (snout-vent length, tail length, body mass, head dimensions, mouth opening) along with colouration of body parts (tail, neck, flanks) and colour patterns of the dorsal side were examined in all age classes. Sexual dimorphism was observed for all the morphometric characteristics of individuals belonging to each mature age class, along with correlations between the body length and the most of the body colour patterns. The presence of broken stripes on the back and yellow colour on the flanks of the body are positively correlated with the snout-vent length (SVL) of both male and female individuals (ANOVA: $p<0,05$) (stripes broke to spots and white flanks obtaining a yellow colour as SVL increase), while the colour pattern of the tail is positively correlated both with SVL and the period of the year (ANCOVA: $p<0,05$). Subadults have a reddish tail that alters to white during maturation in males and yellow in females, while the colour of the neck in females becomes yellow as their age advances. Individuals of the species bear a unique colour pattern on their back that can be seen as a combination of continued or broken light-coloured stripes with brown-red spots on a blackish background. Although these patterns clearly altered during maturation and in the subsequent age classes, they can easily be used for the individual's identification (like a fingerprint) at any age. The results of this study are comparable with similar results from other related lacertids.

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O21.
Fluctuating asymmetry in urban vs. rural populations of *Podarcis muralis*

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Fluctuating asymmetry (FA) regards to minor, random deviations from perfect bilateral symmetry being often used as a measure of developmental stability. Stress, both environmental and genomic has been demonstrated to increase the level of FA in morphological traits. It is suggested that since organisms need energy to compensate for stress, the amount of energy available for growth and maintenance of developmental precision is reduced. Compared to other indicators of stress, FA is easy and inexpensive. Here we tested whether urban populations of *P. muralis*, which are expected to be under higher environmental stress due to exposure to contaminants, show increased levels of FA compared to rural populations. We examined the degree of FA in three morphological traits (number of femoral pores, subdigital lamellae and supracilliary granules) in 10 populations of *Podarcis muralis* - five urban and five rural ones. Trait size dependence, directional asymmetry, antisymmetry and measurement error were quantified for all three traits in both sexes and in all populations. Since all traits fulfilled the FA criteria we proceeded to FA analyses. The degree of FA varied between populations, and also between traits, but not between sexes. Populations inhabiting urban areas showed higher degree of FA when compared to rural ones. Increased FA in urban areas can be a result of nutritional stress of pregnant females and/or embryos, chemical pollution and inadequate incubation temperatures.

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O22.
Sexual Size Dimorphism in the Italian Wall Lizard: Do Size and Age Influence Color Patterns?

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The Italian Wall Lizard, *Podarcis siculus*, is widely distributed throughout most of Italy. These lizards are very variable morphologically, but they have been studied almost exclusively in habitats of the Western Adriatic coast (island and mainland populations of Croatia). It is still unknown if the morphological variation represents a genetic polymorphism or plasticity since the main phenotypic traits have not yet been studied in detail. We examined 114 wall lizards from one beach and one grassland area (5 km apart) on the northern Tyrrhenian coast of Italy to compare phenotypic traits between sexes and between areas. Body size related traits showed a marked sexual dimorphism, with males larger in all considered traits. For the first time in lizards, we estimated age from visual count of parietal scale LAGs: median age of males was three years and median age of females was two years. Large individuals of both sexes have green jaws, whereas smaller lizards have white or grey jaws. Femoral pores were more numerous in males than in females, and fluctuating asymmetry in this trait was evident and differed between sexes and areas. In males, the number of active pores (ratio of secreting pores/total hind limb pores) varied between areas (0.59 vs. 0.71), but not significantly. The number of active pores was positively related to head and body size in males, but was not related to age or to green jaws. Our results suggest that different areas may shape overall morphology in male and female lizards differently.

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O23.
Influence of vegetation cover on tail break frequencies in *Podarcis muralis*

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Vegetation coverage can have a significant effect on lizard populations, providing them with suitable refuges, making them less apparent to predators, and in turn, lowering the predation pressure. Also, increased body condition can be

expected since food availability is increased in habitats rich in vegetation. Here we examined relation between increase in vegetation coverage and change in frequency of broken tails, tick load and body condition in two consecutive years in one local population of *Podarcis muralis*. As a control group we used neighbouring population with similar predators, habitat, climate conditions, but where vegetation coverage did not change within the same time period. Frequency of broken tails decreased considerably in first population, while in the control one it did not change significantly in males. Body condition increased in females in both populations, but in males only in first one. Tick load remained the same in both populations and years. As exposure to predators is the most important factor influencing incidence of autotomy, we can attribute observed changes to decreased susceptibility to predation attacks.

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O24.
Head-body temperature difference in *Podarcis muralis*: experimental evidence

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Evidences of head-body temperature differences are known for many species of lizards and snakes, but not for Italians lizards. In this study, the authors experimentally heated several specimens of the lacertid lizard *Podarcis muralis*, in order to investigate their ability to generate and maintain local temperature differences between the head and the body. The authors put lizards into polystyrene boxes and heated the cages with incandescent lamp. Body temperatures were measured every twenty minutes for two hours with two different tools: an infrared thermometer and an infrared camera. The authors observed a statistically significant temperature gradient from the tip of the nose, the cooler part of the body, to the trunk, the hottest area of the body; head temperature is intermediate between them. *Podarcis muralis* shows a polymorphic dorsal colouration and is sexually dimorphic, but neither sex nor dorsal pattern are associated to temperature differences between specimens. Stationary body temperatures were reached within forty minutes, which means that this species potentially can thermoregulate very fast in optimal temperature condition. This study shows for the first time that the lacertid lizard *Podarcis muralis* can generates and maintains temperature difference between the head and the body. Ecological hypotheses and implications for head-body temperature difference are discussed.

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O25.
Aspects of thermal ecology of meadow lizard (*Darevskia praticola*)

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This study was conducted to determine the variation range of daily and seasonal activity in a local population of a meadow lizard (*Darevskia praticola*) at the north-western edge of species area, compared to the variation of certain environmental parameters - soil temperature (Ts) and air temperatures (T5, T60), humidity (Hu), atmospheric pressure, cloudiness and wind speed. In the adult animals a moderately positive correlation between daily activity (LAI) and ambient temperatures was observed (LAI-Ts = 0.35; LAI-T5 = 0.30; LAI-T60 = 0.34), and a low correlation with the change of humidity (LAI-Hu = - 0.14). For the subadult individuals activity was negatively correlated with ambient temperatures (LAI-Ts = - 0.29; LAI-T5 = - 0.45; LAI-T60 = - 0.33), so that activity decreased with increasing temperature, and increasing humidity also reduced the activity (LAI-Hu = -0.54). Results suggest that meadow lizard requires rather special combination of environmental factors. Activity of lizards, recorded via linear transects, changed during the analysed period, from March to June 2012. The lowest total activity was in March (N - the average number of lizards seen per day - was 12 individuals), and the highest in April (N = 19 individuals). In this population of D. praticola the activity pattern had no distinct regularity. It occurred in the form of unimodal and bimodal, and during some days neither of the two forms was expressed, since the activity was moderate during the day. Differences in activity patterns of adult and subadult individuals were also observed. The established difference in the period of maximum activity between subadult and adult individuals is likely an example of a divergence in the temporal component of the ecological niche.

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O26.
The role of chemical communication in lacertid lizards - PhD prospects and goals

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Animals communicate with conspecifics and other species through an astonishing variety of signals and displays. Which selection pressures and developmental constraints have guided the evolution of the diversity of sending and receiving system through time, has been a much-debated issue for many decades. Studying the evolution of signalling systems may contribute to our understanding of speciation, as the 'Sensory Drive Hypothesis' predicts that divergent adaptation in sensory and signalling systems to different environments can cause premating isolation between populations. The effects of the physical environment on the choice of the sensory channel and the characteristics of the signals within sensory channels have been studied extensively for visual and acoustic communication systems. Much less is known on how the signalling environment affects the evolution of chemical communication. In this PhD project, we aim to examine the evolution of the chemosensorial communication system in Lacertidae. In particular, we will investigate the role of the physical environment in shaping the diversity of signalling and receiving systems. A first study would investigate the signalling system by a family-wide comparison of the role of the physical environment in the evolution of femoral pore numbers. Additionally, we will compare femoral gland and pore morphology among lacertid species living in different signalling environments. In a second section, we will examine a number of characteristics of the femoral secretion itself, and compare this among species living in disparate signalling environments. We hypothesize that the amount and the physical properties of the secretion and the composition of the lipid cocktail will vary with aspects of the environment. At the other end of the channel, reptiles possess a vomeronasal system for processing chemical cues. We aim to explore the interspecific variation in this system for environmentally induced bias. On the basis of symmorphosis, we expect to see that species that invest strongly in the production of semiochemicals, will also be best equipped to receive them. We will compare the morphology of the tongue and the Jacobson's organ among lacertid species. We will test our hypotheses in an explicit phylogenetic context, by drawing a tailored tree from available DNA sequences and considering different models of character evolution. By taking such a comparative approach and correlate interspecific variation in the semiochemicals, the sending system and the receiving system with environmental variables, we'll try to investigate the role of natural selection in shaping chemical communication in lacertid lizards.

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POSTERS

P1.
Is ecophysiology in accordance with current distribution for the four species assigned to *Algyroides*?

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The ecology of the lacertids genus *Algyroides* is still poorly known. Nevertheless, all four species recognized, *A. nigropunctatus*, *A. moreoticus*, *A. fitzingeri* and *A. marchi*, display some degree of restriction in distribution and habitat use when compared to other Mediterranean genera. As for other ectotherms with low dispersal abilities, in absence of other forces, such spatial restrictions are expected to be linked to ecophysiological constraints. Here, we test such prediction by focusing on two crucial features of reptilian life, thermal preferences and water loss. We performed two consecutive experiments in order to determine preferred body temperatures (Tp) and water loss rates (Wl). Tp of 5-10 adult males by species was hourly monitored in a photothermal gradient for a ten-hour period. Subsequently, Wl was estimated by placing the same specimens in sealed chambers with silica gel and weighing them hourly during a 12-hour period. Both Tp and Wl differed in mean and time profiles across species, which were arranged into two groups regarding their ecophysiology. Namely, under standard conditions, *A. nigropunctatus* and *A. fitzingeri* selected for lower temperatures but lost less water than *A. moreoticus* and *A. marchi*, although the existence a trade-off between Tp and Wl was unclear. While significant size variation between all species exists (A. fitzingeri and *A. marchi* being dwarfed), neither SVL nor body mass accounted for the differences in ecophysiology recorded. It is, hence, concluded that intrinsic (size/shape-free) differences in thermal and hydric physiology (high Tp and Wl) may be responsible for the decrease of the ranges and habitats available suffered by *A. moreoticus* and, mainly, by *A. marchi*. Such process is likely to be linked to the spread of Mediterranean climate during the Pliocene.

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P2.
Preliminary analysis on gastrointestinal helminths parasitizing *Darevskia* spp. (Lacertidae) from North and Eastern Turkey

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Caucasian rock lizards genus *Darevskia* (Arribas, 1977) are small lacertids inhabiting saxicolous environments from Western Asia and Southeastern Europe. Unlike other lacertid genera, *Darevskia* includes both bisexual and parthenogenetic forms, which are now object of an integrated study to elucidate the patterns of reticular evolution and coexistence within this group. From the helminthological point of view, data available for the most are partial and scarce, mainly focused on taxonomy and faunistics. Recently, voucher contents of the gastrointestinal helminth fauna were available ten *Darevskia* species from Northern and Eastern Anatolia. Hosts were dissected, and their digestive tracts were sent to the Laboratory of Parasitology (University of Valencia) for analysis. Of all the hosts analysed, eight helminth species were found, one cestode, *Nematotaenia tarentolae* López-Neyra, 1944, and seven nematodes, *Skrjabinodon* sp., *Spauligodon saxicolae* Sharpilo, 1961, Pharyngodonidae gen sp1, Pharyngodonidae gen sp2, *Skrjabinelazia hoffmanni* Li, 1934, *Strongyloides* sp. and *Oswaldocruzia* sp*.* Both Pharyngodonidae (only females found) showed characteristics of the genera *Spauligodon* or *Skrjabinodon*. Values of global prevalence and mean intensity and abundance were low. Comparison with the deeply analyses previously conducted for the lacertids of Iberian Peninsula showed that *Darevskia* spp*.* are less infected by gastrointestinal helminths than *Podarcis* spp*.* Only *P. bocagei* (Seoane, 1884) and *P. carbonelli* Pérez-Mellado, 1981 from Northwestern (Portugal) displayed similarly low infection prevalences than searched *Darevskia* spp. As in *Podarcis* spp., Pharyngodonidae nematodes found in *Darevskia* spp*.* belong to the evolutionary lineage of carnivorous reptiles, in accordance to the carnivorous diet reported for *Darevskia* spp*.* From a geographical point of view, it seems that helminthfauna of species of this genus, is mainly composed by Eurasiatic species, together with oriental and endemic elements, and lacking of typical Mediterranean and north African helminth elements.

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P3.
Depauperate helminth community in the parthenogenetic lacertid *Darevskia uzzelli* (Darevsky et Danielyan, 1977) endemic from NW Turkey

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Darevskia uzzelli (Darevsky et Danielyan, 1977) is a parthenogenetic lacertid lizard endemic to a restricted range in the vicinity of Horasan and Selim, NE Anatolia. Twenty specimens were captured from two different populations and analyzed for gastrointestinal helminthes. Only one male and one female of the nematode *Skrjabinodon* sp. (Pharyngodonidae) were found in two of the searched hosts. In consequence, the infection and diversity parameters were extremely low ant suggest a depauperate helminth community for this parthenogentic lacertid lizard. In fact, the infection and diversity values fall among the lowest within the Palaearctic saurians. Comparison of our results with those known for the parthenogenetic teiid species of the New World genus *Aspidoscelis* Fitzinger, 1843 (former *Cnemidophorus*), suggests some features that may characterize the helminth faunas of unisexual lizards: (i) very poor helminth communities; (ii) they share parasites with most other congeners; (iii) Pharyngodonidae nematodes are the most important parasites in these depauperate helminth communities. Some hypothesis on the evolution on sex suggest that identical clonal lineages should be more vulnerable to parasitism over time than genetically diverse sexual lineages. If so, parthenogenetic lizards should harbour more parasites than their recent unisexual parental ancestors. Nevertheless, some other studies do not corroborate that hypothesis. Although we have not compared the helminth communities of *D. uzzelli* with those of *D. valentini* (Boettger, 1892) and *D. raddei* (Boettger, 1892) (parental lineages), present results also deviate from the above mentioned hypothesis. An alternative possible reason for this extremely poor helminthfauna found in *D. uzzelli* may be the decreasing of opportunities for interchanging helminthes with direct life cycles, since less intra- and interespecific contacts are expected among unisexual lizards than among bisexual ones.

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P4.
Evolutionary and demographic history of the Maltese wall lizard *Podarcis filfolensis*

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We investigated the phylogeography and historical demography of the Maltese wall lizard *Podarcis filfolensis* using both mitochondrial and nuclear genetic markers. We included samples from all the main islands of the Maltese and Pelagian archipelagos and from every islet and offshore rock where this species occurs. The phylogenetic analyses show two main mitochondrial phylogroups, one occurring in the island of Malta and the islet of Filfla (Maltese lineage) and the other one mainly distributed on Gozo and Comino islands and their surrounding islets, and on the Pelagian islands (Gozitan lineage). We discuss what demographic dynamics and microevolutionary processes have been involved in shaping the pattern of genetic diversity and distribution of P. filfolensis within the general framework of Pleistocene biogeography of temperate biota in coastal areas.

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P5.
Spectral data suggest local adaptation in *Podarcis muralis*` dorsal cryptic coloration

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Natural and sexual selection interact in the design of animal colourations. Lizards often show their conspicuous colourations in relatively concealed body surfaces, such as the throat, belly or ventrolateral surfaces, while dorsally colours are less striking and less sexually dichromatic. In lacertids, the design of dorsal colourations has traditionally been explained by its cryptic function. If this interpretation is correct, we should expect to find differences in the

dorsal colouration of lizards inhabiting ecosystems with substrates of different colours. To test this hypothesis, we used spectrophotometric techniques to obtain objective measurements of dorsal colouration from eight populations of *Podarcis muralis* (Laurenti, 1768) and their respective natural backgrounds (i.e. rocks). We then performed correlative analyses of the three independent variables that describe colour (i.e. brightness, chroma, and hue). Results show that, although there is little variation in the spectral parameters of dorsal colourations, there is a significant positive correlation between lizard and rock colouration in hue ($r = 0.852$, $P = 0.007$), but not in chroma ($r = 0.068$, $P = 0,873$), while the correlation involving brightness is only marginally significant ($r = 0.667$, $P = 0.071$). When we control for body size, the correlation involving hue remains strongly significant ($r = 0.967$, $P = 0.002$). These results support the general hypothesis that lacertid dorsal colouration has been selected for a cryptic function, and suggest that it is a locally adapted trait, at least in hue.

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P6.
Body temperature and activity of *Acanthodactylus schreiberi* (Sauria: Lacertidae) from a sand-dune ecosystem in Cyprus

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Body temperature and activity patterns of the lacertid lizard *Acanthodactylus schreiberi schreiberi* were studied during 2009 in a well preserved dune ecosystem on the island of Cyprus. Body temperatures, along with air and substrate temperatures were measured at the capture moment in the field using a cloacal thermometer. Activity patterns in the population under study were documented through monthly sampling. The information resulting from these measurements was linked to existing temperature data from selected microhabitat sites in the study area (substrate surface in bare sand, shaded area inside bush, air at 5cm above the substrate surface, borrow under bush). The mean annual body temperature of adult lizards was found to be 35.5°C (range=29.2–39.6; SD=2.48). No difference

was observed between sexes but subadults had slightly lower mean body temperatures than adults. This is attributed to the smaller body size of subadults since body temperature was found to be positively correlated with snout-vent length of individuals. Body temperature is highly correlated with air temperature (5cm above substrate surface) on a yearly, monthly and daily basis. During summer, a high correlation between the hour of the day and body temperature was found during the first hours of the day (morning thermoregulation), while no correlation is obvious after 09:30. Our results on lizards' activity show that individuals remain active during the whole year although they minimize their presence during the cold period of winter. During spring and autumn lizards can be observed throughout the day with a peak before midday, while in summer they avoid being active during the high temperature period of noon. Hourly temperatures from selected microhabitats in comparison with body temperatures during the same daily period can explain this behaviour. The results of this study are parallel with similar results from other related lacertid species.

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P7.
Evolution of conspicuous complex colour patterns in lacertids: selection for conspicuousness favours complex contrasting colour patterns

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Many animal conspicuous colourations are involved in signalling processes. Contrasting colour patches often increase the conspicuousness of a colour pattern and enhance signal detection. Recent results suggest that the ventrolateral ultraviolet (UV) patches of *Podarcis muralis* (Laurenti, 1768) convey information about male individual quality. In contrast, the ventral long-wavelength colourations (i.e. orange, yellow and white) are not related with male quality, but may act as amplifiers of UV patches strongly increasing their detectability. As these two types of colourations are frequent among lacertids, we predict that, if the entire conspicuous colour pattern (ventrolateral or lateral UV + ventral long/medium-wavelength) is selected for signalling, these two colourations should covary throughout lacertid evolution. We performed a comparative phylogenetic study involv-

ing 141 species to test whether lateral and ventrolateral colourations (e.g. UV-blue eyespots) are correlated with ventral colourations (e.g. orange, yellow). We used descriptive information about lacertid colourations collected from the literature. However, as colour classifications based on the human visual system are intrinsically biased and may lead to incorrect conclusions, our colour classification was based on a subsample of 43 species for which spectrophotometric data were available. Our results demonstrate that the two conspicuous colourations of lacertids are related throughout their phylogeny (Pagel analysis: difference in log likelihoods = 7.34, P = 0.01). These results suggest that selection promotes the evolution of the entire complex pattern rather than the acquisition of a single conspicuous colourations), possibly due to the increased conspicuousness caused by the combination of colours with different spectral properties.

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P8.
Escape behaviour of *Podarcis* of some Mediterranean islets

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Predation is one of the major selective forces in the evolution of many behavioural traits, particularly in animals subjected to high predation rates, like lizards. Many factors as predation pressure and habitat complexity are known to shape escape behaviour in lizards. We investigated if different *Podarcis* species display a similar escape behaviour under similar environmental conditions. We analyzed data from 9 Mediterranean islets: three in eastern Corsica, three in north-eastern Sardinia, inhabited by *Podarcis tiliguerta*, and three in the eastern coast of the Adriatic sea, inhabited by *P. melisellensis* (Pm, n=62). Islets were all small in size (from about 1 to 22 ha), characterised by comparable predation pressure (hosting no potential ground predators, i.e. snakes, rats), and were classified in two categories of habitat structure complexity. We considered two main traits of escape behaviour: flight initiation distance (FID) and distance fled (FLD) (Kruskall-Wallis and Mann-Whitney U tests were used). *P. tiliguerta* from Corsica (Ptc, n=97) and from Sardinia (Pts, n=86) were analysed separately following recent studies suggesting substantial morphological and genetical differences between the two groups. Our results highlighted that in *Podarcis* the level of wariness was quite a variable feature, linked more to population variability than to differences among species. Ptc displayed

the longest FID (significantly longer than Pts, P=0.006), probably to compensate with a greater level of awareness its lower locomotory efficiency due to smaller size (Ptc showed the smallest SVL considering the studied islets). FLD, on the contrary, was a less variable trait, likely related to the escape strategy of individuals: *Podarcis* populations of different species and islets run comparable distances when escaping, and lizards that hid in a refuge run significantly shorter distances than lizards that just stopped without hiding.

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P9.
Comparison of femoral gland secretion's chemical composition between male colour morphs in common wall lizard (*Podarcis muralis*)

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Colour polymorphism has been described in many animal taxa, with two or more different morphs coexisting within the same population and often associated to different life history and behavioural traits such as alternative reproductive or social strategies. Reptiles offer an excellent model to investigate the evolution and maintenance of colour polymorphism since it's quite common and is frequently associated in both sexes with the evolution of alternative behavioural strategies (competitive and/or reproductive) related to social context. The presence of alternative colour morphs has also been observed in the common wall lizard (*Podarcis muralis*), in which both sexes show three main distinct colour morphs in the throat and ventral region. Chemical senses have an important role in intraspecific communication and social organization of lizards, which use chemical cues for different purposes, such as advertising residence or informing on dominance status or male's characteristics, which females may use to select mates or take residence in a male's territory. In this study, we used gas chromatography–mass spectrometry (GC-MS) to explore whether there is chemical polymorphism in the lipophilic fraction of femoral gland secretions between male colour morphs. All compounds were shared by most males but there were differences in proportion of compounds between

morphs. Pairwise comparisons showed that white morph lizards had significantly different chemical profiles than both yellow and red ones, but differences between yellow and red morphs did not reach significance. A CAP analysis classified on average 67.2 % of the chemical profiles into the correct morph (white: 85.0 %, red: 60.9 %, yellow: 57.1 %). Finally, there were significant differences between morphs with respect to the proportions of tocopherols and furanones, but morphs did not differ significantly in proportions of other classes of compounds.

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P10.
The effect of floods on habitat selection of the sand lizard (*Lacerta agilis*) in riverside flood zones

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Knowledge on habitat use of animal species is important for its effective conservation. In Slovenia the sand lizard (*Lacerta agilis*) is according to current knowledge distributed mainly in the river valleys. However, the impact of floods on its habitat selection in river valleys is not known. Therefore the main goal of our study was to establish the flood effect of the distribution of the sand lizards at river banks of the river Drava in NE Slovenia. We used the transect survey method with transects located outside the flooded area and in three different flood zones: (1) exceptional floods (every 50 years), (2) occasional floods (every 10 to 20 years) and (3) frequent floods (every 2 to 5 years). The areas with frequent floods have been flooded every year in the last five years as well as during the study year when also a part of the zone with occasional floods has been flooded. Surveys had been conducted in two different seasons (spring and summer) in 2012 and in good weather conditions. We have found out that the distribution of lizards is significantly confined to areas with floods since most of the lizards were recorded in zones with frequent and common floods. No sand lizards were found outside the floodplain. The seasonal differences were observed in adults, which more frequently occupied areas with

occasional floods in spring and areas with frequent floods in summer. On the contrary, juveniles were present almost exclusively in areas with occasional floods. The direct effect of floods was also observed since in 2012 water covered numerous transects with more than 100 cm. The next day after the water retreat, the transect surveys revealed that the number of lizards corresponds to previous counts before flood event. We suggest that the sand lizards select the floodplains significantly and its population is even able to sustain flood events, therefore the species can be a useful indicator species for assessing the ecological state of river floodplains.

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P11.
Life style affects tail regeneration in lizards

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Tail autotomy is one of the main antipredator strategies in lizards. The mechanical pressure exerted by the predator induces an immediate break of the tail. Lizard escapes while the autotomized part thrashes vigorously distracting the predator. Caudal regeneration occurs rapidly in most lizard families and compensate for the disadvantages that tail loss comes with. Among the most important problems is the impaired locomotion. Tail serves as an auxiliary movement instrument and thus caudal shedding alters numerous locomotive features such as balance, speed, climbing ability etc. The quicker lizards will regenerate their tail, the faster their motion abilities will be restored. The duration of tail regeneration varies among lizard families and it seems to depend on phylogeny. In this study we aimed to clarify the impact of life style on caudal regeneration. We predicted that lizards that have a more intense movement pattern (e.g. run more and faster) would regenerate quicker their lost tail. In order to minimize the phylogenetic effect, we worked with three closely related species of the genus *Podarcis* that have different life styles, affecting the movement pattern: *P. tauricus* leaves in open areas and is a cursorial species, *P. peloponnesiacus* prefers low rocks next to flat terrains, running and climbing evenly good and *P. muralis* is found on rocks and walls and is an excellent climber. To simulate predation, we grasped with a pair of callipers the tail at a distance of 30 mm from the cloaca. Lizards were previously placed in a terrarium covered with rough cork mat, allowing them to maintain good traction. If autotomy occurred, lizards were housed in individual terraria at 30 C and

were fed on mealworms (*Tenebrio molitor*). Tail length was recorded weekly to the nearest second decimal, using a ruler. Measurements began the first week after autotomy and were taken for 23 weeks. The weight and the length of each autotomized tail were measured. Tail regeneration was faster in the case of *P. tauricus*. *P. peloponnesiacus* grew its caudal tissues in a slower but yet comparable way whereas *P. muralis* showed the slowest regeneration rate and did not acquire the full length of the original tail. We believe that the underlying reason for these results is the different use of the tail in each species. *P. tauricus* is a swift runner and uses its tail as a counterbalance. The other two species are more climbing-oriented and tail is less important. It seems that according to their particular life-style, lizards regenerate their tails in a different rate.

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P12.
Relationships between head morphology and diet in island and mainland populations of the Balkan green lizard (*Lacerta trilineata*) from Greece

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Head morphology and head size in lizards have been traditionally associated with ecological and behavioral features such as feeding, mate success and aggressive performance. The relation between head size and bite performance is adequately direct, and individuals with larger head exert higher maximal bite force. On the other hand, bite force is a valuable indicator of prey choice and feeding strategies of animals. In the present study we examined the head morphology and feeding ecology between island and mainland Greek populations of the Balkan Green Lizard, *Lacerta trilineata*. We investigated how natural and sexual selection can affect head traits. We applied geometric morphometrics for a total of 154 adult *L. trilineata* individuals (20 females and 48 males from the islands and 30 females and 56 males from the mainland). For each individual, stomach content was also analysed. Apart from taxonomic classification, preys were also classified based on hardness measurements obtained from previous prey-crushing studies. All the examined animals were deposited to the Herpetological Collection of the Natural History Museum of

Crete. Analyses of morphology indicated significant morphological differences both between sexes and between mainland and island populations. Males had, in general, larger heads than females. Moreover, insular and mainland lizards of the same sex differed in head size but not in body size. The analysis of stomach content revealed a significant difference on the diet between sexes and between mainland and island populations. Our findings suggest that the observed differences in head traits may partly reflect the trophic ecology of different *L. trilineata* populations.

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P13.
First molecular characterization of the genus *Anatololacerta* and validation of morphological subspecies with mitochondrial markers

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Anatololacerta is a genus recently erected for a small group of lizards endemic to Western Anatolia (Turkey) and some neighboring Greek islands. Three species are generally recognised: *A. danfordi* (Günther, 1876), *A. anatolica* (Werner, 1900), and *A. oertzeni* (Werner, 1904). Other subspecific taxa described are: *pelasgiana* (Mertens, 1959), *pentanisiensis* (Wettstein, 1964), *quandttaylori* (Börner, 1974), as well as aegaea, budaki, finikensis, ibrahimi, described on morphological bases by Eiselt & Schmidtler (1986). In a chemosystematic study based on albumins, Mayer & Lutz (1989) stated that "The biochemical differences between *L. danfordi*, *L. oertzeni* and *L. anatolica* are too small to confirm their taxonomic revalorisation". Following these authors, Sindaco & Jeremčenko (2008) considered all the taxa as belonging to a single species, *A. danfordi*. Anyway, the taxonomic value of the described taxa has not yet been addressed with molecular techniques. We performed a molecular phylogenetic analysis using two mitochondrial markers (12S rRNA, cytochrome b) on 32 museum specimens, representative of all described taxa except *A. o. oertzeni*, *A. o. pentanisiensis* and *A. anatolica* aegaea. We inferred Maximum Likelihood and Bayesian phylogenetic trees using the sister-taxon Parvilacerta

as an outgroup. We also obtained haplotype network reconstruction based on parsimony algorithm to elucidate phylogeographic relationships within distinct clades. Results showed that at least *A. danfordi* and *A. anatolica* appear well differentiated at mitochondrial markers, whereas a higher genetic variation characterized *A. oertzeni*. Interestingly, genetic variation did not match the subspecific classification of specimens based on morphology. Further studies with nuclear markers are highly desirable to better resolve the phylogeny and the systematics of the genus.

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P14.
Molecular evidence of genetic differentiation among sympatric colour morphs of the common wall lizard (*Podarcis muralis*)

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Colour polymorphism is widespread in reptiles, but the mechanisms underlying the evolution and maintenance of alternative morphs are still poorly understood. Among lizards, several studies have been carried out to investigate the adaptive value of alternative colourations, which are often associated with several life-history traits (immunological, physiological and behavioural) as a result of correlational selection favouring co-adapted gene complexes in a sexually-selected runaway process. The common wall lizard (*Podarcis muralis*) shows three pure ventral colour morphs (white, yellow and red) and two intermediate, di-chromatic phenotypes (yellow-red and white-red) in both sexes and within the same population. Colourations are expressed at the time of sexual maturity and no continuous variation occurs among them. Moreover, they do not shift to one another once expressed; strongly suggesting that morph might be, at least partially, genetically determined. Previous studies have shown that morphs differ in immunological, haematological and physiological traits, as they play alternative strategies to achieve different fitness optima to cope with selective pressures. Recently, evidence of non-random mating has been provided both by field observations and captive-breeding experiments. In theory, positive assortative mating within the same morph and selection against hybrids could increase the potential for polymorphism in driving divergent evolution among morphs, as a first step towards even-

tual reproductive isolation and sympatric speciation. We selected hypervariable molecular markers (8 microsatellite loci) to study genetic differentiation among morphs in three northern Italian populations, by estimating and comparing allele frequencies and deviation from the Hardy-Weinberg equilibrium between morph classes and in the populations considered as single panmictic units. Observed variation in the genetic composition of morph classes within each population matched previous evidence of non-random mating between colour morphs, suggesting intra-specific genetic divergence driven by colour polymorphism in common wall lizards.

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P15.
Comparative analysis of two close related forms of lizard *Darevskia "raddei"* and *D. "nairensis"*

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In order to decide a disputed taxonomic rank of two close forms of rock lizards of genus *Darevskia* we compared form *"nairensis"* from the city of Yerevan in the gorge of Razdan river (1006 m above sea level) and *"raddei"* from a vicinity of the Geghard monastery in the gorge of Azat river (1940 m) approximately at distance of 24-25 km from each other. Morphological researches have shown their similarity: *"nairensis"* and *"raddei"* significantly differ only by number of dorsal scales ($P<0.01$ for both sexes) and scales between the masseteric shield and the supratemporal ($P<0.01$ for males and $P<0.001$ for females), where the number of scales of *"raddei"* exceed that of *"nairensis"*. Despite the close morphological similarity, earlier was suggested that two close forms of lizards may be reproductive isolated. Our researches have shown that terms of breeding of males and females of *"nairensis"* were on 7-10 days earlier than *"raddei"*, however this may result of different climate conditions in concerning with elevation. Our parasitological observation of blood smears have shown that two forms of lizards contain different forms of blood parasites, where *"nairensis"* were infected mostly by parasites identified according to their morphology as specimens of genus Karyolysus, while *"raddei"* were mostly infected by parasites of genus Hepatazoon, which also may result of different habitats rather than species rank differences.

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P16.
Species composition of reptiles in three different habitats

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Species composition and abundance of reptiles was examined in three different habitats on the island of Cres (Croatia) adjacent to the town of Osor in May 2013. The aim of our study was to examine the sensitivity of biodiversity and similarity indices in reptiles. In each habitat visual observations of reptiles were made by groups of 10 people for 1 hour along a 1 km sampling path. In the first habitat, overgrown pastures surrounded by stone walls, 5 lizard (*Podarcis melisellensis*, *Algyroides nigropunctatus*, *Podarcis muralis*, *Lacerta viridis* and *Pseudopus apodus*) and 2 snake species (*Hierophis gemonensis* and *Elaphe quatuorlineata*) were observed. In the second habitat, a gravel road on Osorščica hill surrounded by macchia, 3 lizard (*P.melisellensis*, *A. nigropunctatus* and *L. viridis*) and 2 snake species (*H. gemonensis* and *E. quatuorlineata*) were found. In the final habitat, stone buildings and walls in the town, 3 species of lizards (*P. melisellensis*, *A. nigropunctatus* and *Dalmatolacerta oxycephala*) were recorded. The dominant species in all three habitats was the Dalmatian Wall Lizard (*P. melisellensis*). Two biodiversity indices were applied to the data. Simpson's diversity index indicated that that the second habitat (0.56) had the greatest diversity in terms of species and their abundance, while the Margalef's index indicated that the first habitat had more diversity (1.69). In addition, Jaccard's index of similarity indicated that the urban habitat was dissimilar to the other two, while the Bray-Curtis dissimilarity index showed a weak differentiation between the overgrown pastures and the other habitats. The discrepancy in the outputs from the indices highlights the importance of choosing an appropriate mathematical construct to examine biodiversity and habitat similarities.

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