

Distribution and habitats of the Sand Lizard (*Lacerta agilis*) in Latvia

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Abstract

The aim of the paper was to summarize the data on distribution and habitats of *Lacerta agilis* in Latvia. Data on distribution of *Lacerta agilis* was collected by the author and other observers in 1990 - 2006. Records were made more frequently in the Coastal Lowland, in stretches of valleys of large rivers, and in South-Eastern Latvia. Habitats were described in the field on circular plots with a radius of 1.5 m for herbs, 5 m for shrubs, and 10 m for trees using a modified Braun-Blanquet method; a total of 32 plots were established. Principal Component Analysis was used to detect natural groups of habitats. Vegetation composition in all the plots was similar, in about 75 % dominated by grasses, and in 25 % by *Calluna vulgaris*. Detailed vegetation description is given.

Key words: distribution, habitat, *Lacerta agilis*, Latvia, Principal Component Analysis, vegetation cover.

Introduction

The Sand Lizard, *Lacerta agilis*, is a medium-sized lizard with a wide distribution range, from the Pyrenean Mountains, Southern England and Southern Scandinavia to Central Asia and Mongolia (Arnold, Ovenden 2002). About ten subspecies of *Lacerta agilis* are recognized (Kalyabina-Hauf et al. 2001). Populations are large in southern and eastern parts of the range (Jablokov 1976), but north-west European populations, belonging to subspecies *L. a. agilis*, and northern populations of *L. a. chersonensis* are generally rare and considered as declining (Edgar, Bird 2006). The population living in the territory of Latvia presumably belongs to the latter subspecies found in Eastern Europe and Western Russia (Jablokov 1976; Kalyabina-Hauf et al. 2001), although study is insufficient. The species is included in the Annex IV (strictly protected species of community interest) of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

Lacerta agilis is considered to be a rare species in Latvia (Andrušaitis 2003), and is included in the strictly protected species list by the Cabinet of Ministers of Latvia regulation Nr. 396/14.11.2001. In spite of this status, the information on the distribution and habitats of *Lacerta agilis* in Latvia is scanty. Arguably the best general description of the species ecology was published more than 70 years ago (Siliņš, Lamsters 1934). All of the published information is either a popular species account (Siliņš, Lamsters 1934; Sloka

1961; Lipsbergs et al. 1990; Andrušaitis 2003), based mostly on other literature sources, annotated checklists of fauna of some protected areas (Barševskis et al. 2002; Čeirāns 2002, 2003), or wider studies on reptile ecology with minor emphasis on *Lacerta agilis* (Čeirāns 2004; 2006). A species distribution map in Latvia has never been published.

The aim of the present paper was to summarize data on the distribution of *Lacerta agilis* in Latvia, and to describe and classify the species habitats, which is necessary for effective habitat management and conservation measures.

Materials and methods

Data on the distribution of *Lacerta agilis* were collected mostly by the author, but was supplemented by communications from other observers, mainly biologists and naturalists. Communications were verified by verbal species descriptions from the correspondents. Data before 1990 are not taken into account as earlier literature lacked exact site locations, and oral communications on the time-span before 1990 were few and probably do not reflect real situation any more. The species distribution map was prepared using the Latvian co-ordinate system (LKS-92) 5 × 5 km grid.

Habitat data were collected in *Lacerta agilis* locations in different regions of Latvia in 2001 - 2005. Only vegetation was described, in circular plots with a centre in the point where the specimen was first spotted. A radius of 1.5 m was used for moss layer and herbs, 5.0 m for shrubs, and 10.0 m for trees. A modified Braun-Blanquet method was used. Vegetation cover was estimated visually, and described separately for five different height classes. A total of 43 taxa and ecological groups were represented. The latter were selected arbitrarily, on the basis of literature (Pētersone, Birkmane 1980; Fitter et al. 1984; Fitter et al. 1996) and author's personal experience. Ecological groups were larger groups of plant species, not necessary taxonomically closely related, with similar habitus and ecological (such as soil and light) demands. Easily identifiable and frequent taxa (tree, undershrub, and some herb species) were treated at a species level. To reduce possible estimation error, the coverage was coded as whole number from 1 to 5 (Table 1). Number of plots in each site was limited to maximum three randomly selected plots from a single location of *Lacerta agilis* to reduce the effect of a few well-studied sites on a total microhabitat data pool. A total of 32 plots were described. Most of them were located in central (Riga district, 12 plots) and southeastern (Daugavpils district, seven plots) Latvia, although plots were made also from other regions (western, north-central). Cluster analysis did not reveal any regional clusters. The length of the first gradient (3.1) in Detrended Component Analysis (DCA) indicated linear response of the vegetation data (Van den Brink et al. 2003). Therefore, Principal Component Analysis (PCA) with inter-sample distances, with no centering or standardization, was selected to detect natural groups of the plots. All statistical analyses were conducted on CANOCO 4.5 for Windows.

Results and discussion

The Sand Lizard *Lacerta agilis* was recorded in 65 squares, or ~2.5 % of the total in Latvia (Fig. 1). Records were more common in three areas: (a) the Coastal Lowland, especially west and south-east from the Gulf of Riga; (b) parts of stretches of valleys of large rivers, particularly the Gauja and Daugava, with neighboring dry pine forest areas; (c) south-

Table 1. Vegetation characteristics in *Lacerta agilis* habitats in Latvia. Unimportant variables (small coverage on few plots) omitted. (a) coded as follows (except for mosses): 0 - absent; 1 - scanty (cover 1 - 5 %); 2 - rare (6 - 14 %), 3 - medium (15 - 33 %), 4 - common (34 - 67 %), 5 - abundant (>67 %); the moss layer: 0 - not developed (coverage <10 %), 1 - poor (10 - 32 %), 2 - medium (33 - 67 %), 3 - well developed (>67 %). (b) small, tufted grasses on infertile soils with all leaves thread-like (*Koeleria glauca*, *Nardus stricta*, *Festuca ovina* agg.). (c) medium-sized loosely tufted or tufted grasses on xero-mesic soils with all or some leaves thread-like (*Deschampsia flexuosa*, *Festuca rubra*). (d) mesic grasses with flat leaves (*Festuca pratensis*, *Poa pratensis*, *P. trivialis*, *Dactylis glomerata*, *Bromus arvensis* etc). (e) medium-size herbs with simple narrow to elliptical leaves from *Asteraceae* (*Taraxacum* spp., *Crepis* spp., *Senecio* spp., *Centaurea* spp., *Hieracium* spp. etc), *Campanulaceae* (*Jasione montana*), and *Dipsacaceae* (*Knautia arvensis*) families. (f) tall or climbing herbs from the *Fabaceae* family (*Vicia* spp., *Lathyrus* spp., *Astragalus* spp., *Melilotus* spp.). (g) small plants on bare places with succulent-like, fleshy leaves (*Sedum acre*, *Honckenya peploides*)

Variable	'Heath' habitats (n = 8)			'Grassy' habitats (n = 23)		
	% of plots present	Coded ^a average of coverage ± SD (maximum value)	Weighted average of coverage %	% of plots present	Coded ^a average of coverage ± SD (maximum value)	Weighted average of coverage %
Vegetation height layer						
Shrubs & trees (> 1.0 m)	75	1.9 ± 1.4 (3)	14	57	1.3 ± 1.6 (5)	12
Tall herbs (> 0.50 m)	25	0.4 ± 0.7 (2)	2	61	1.1 ± 1.2 (4)	7
Medium tall herbs (0.15 - 0.50 m)	100	3.3 ± 1.6 (5)	41	91	2.9 ± 1.3 (5)	30
Low-grown herbs (< 0.15 m)	75	2.3 ± 1.8 (5)	25	43	1.3 ± 1.5 (4)	12
Moss layer	100	1.8 ± 0.7 (3)	44	43	0.7 ± 0.1 (3)	20
Wooded vegetation						
<i>Pinus sylvestris</i>	63	1.4 ± 1.3 (3)	9	57	0.9 ± 1.0 (3)	5
Deciduous trees	37	0.9 ± 1.2 (3)	6	57	1.1 ± 1.4 (5)	9
Grasses						
Xeric grasses ^b	50	1.3 ± 1.6 (4)	11	13	0.2 ± 0.6 (2)	1
Meso-xeric grasses ^c	37	0.8 ± 1.2 (3)	5	22	0.6 ± 1.1 (3)	4
Mesic grasses ^d	13	0.4 ± 1.1 (3)	3	52	1.3 ± 1.4 (4)	10
<i>Calamagrostis</i> spp.	0	0	0	52	1.2 ± 1.3 (4)	9
Undershrubs						
<i>Calluna vulgaris</i>	100	3.1 ± 1.2 (5)	34	13	0.4 ± 1.2 (4)	4
<i>Vaccinium vitis-idaea</i>	37	1.0 ± 1.6 (4)	10	4	0.2 ± 0.8 (4)	2
Other herbs						
Narrow-leaved herbs ^e	0	0	0	43	0.7 ± 1.1 (3)	4
<i>Fabaceae</i> (tall) ^f	0	0	0	30	0.3 ± 0.5 (1)	1
<i>Artemisia</i> spp.	13	0.1 ± 0.4 (1)	1	57	0.8 ± 0.8 (3)	3
<i>Onagraceae</i>	0	0	0	22	0.3 ± 0.7 (3)	2
<i>Galium</i> spp.	0	0	0	30	0.5 ± 0.9 (3)	3
Small 'succulents' ^g	0	0	0	26	0.4 ± 0.6 (2)	1
Moss layer						
Lichens on ground	67	2.4 ± 1.8 (5)	25	4	0.1 ± 0.4 (2)	1

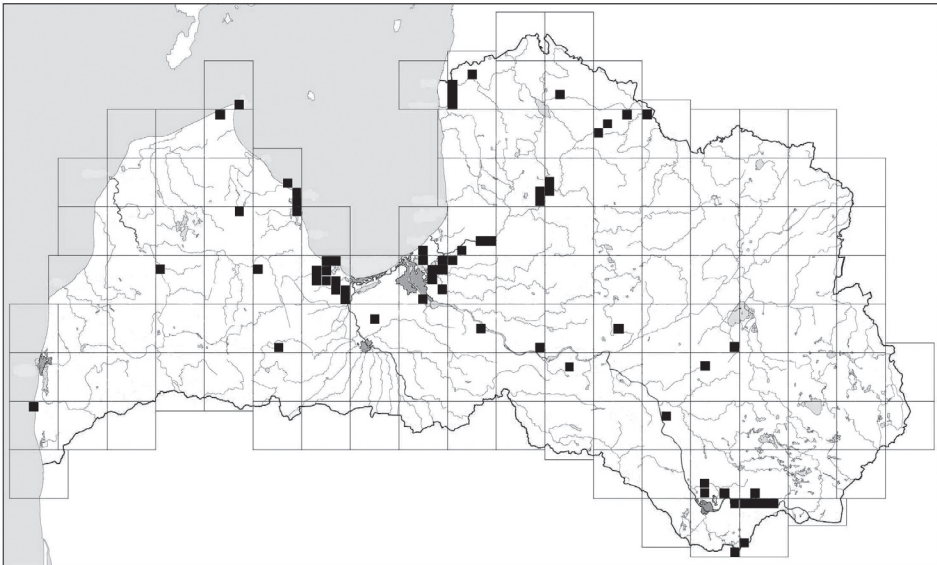


Fig. 1. Distribution of *Lacerta agilis* in Latvia in 1990 - 2006; black are 5 × 5 km squares in LKS-92 co-ordinate system with one or more *Lacerta agilis* records.

eastern part of Latvia. The above distribution can partly be explained by better investigation of some of these areas, particularly the vicinity of Riga.

An uneven distribution pattern, however, is confirmed by a vast field survey conducted in 1999 - 2003 (Čeirāns 2006). *Lacerta agilis* is probably naturally absent in uplands of northern and eastern Latvia due to unfavorable climatic conditions. All the known records are below 100 - 125 m a.s.l., excepting in south-eastern Latvia, where the species is found at elevations about 160 m a.s.l. The latter region also has the most suitable climate for *Lacerta agilis* in Latvia due to particularly high summer temperatures (Čeirāns 2006).

Lacerta agilis was not recorded in south-central Latvia (Zemgale Lowland), an area of intensive agriculture on rich soils that in the past supported mainly broad-leaved forests. Both habitats are not characteristic for *Lacerta agilis* in Latvia. However, the species is recorded in the neighboring Lithuanian part of the Zemgale Lowland (Trakimas 2005), and records in south-central Latvia are still possible.

In Central Sweden, at about the same latitudes as Latvia, species records are confined to open pine (*Pinus sylvestris*) forest areas on sandy glacio-fluvial sediments (Berglund 2005). The present data indicate similar habitat preference in Latvia, as: (a) the species was recorded mainly in an area of various plain habitats on sandy soils (see a map of Latvian landscape types published by Kavacs 1998); (b) disturbed and altered dry pine forests are also the most important among *Lacerta agilis* habitats in Latvia (Čeirāns 2004, 2006), and in neighboring countries - Lithuania (Gruodis 1987) and Belarus (Pikulik et al 1988).

The expected presence of *Lacerta agilis* populations in Latvia is expected to be 10 - 15 % of the 5 × 5 km squares (Čeirāns 2006). Hence, the present distribution of the species is not sufficiently documented, and many new records, especially in lowland areas of western Latvia characterized by dry pine forests on predominantly sandy soils, are expected.

A classification of *Lacerta agilis* sites based on vegetation characteristics was proble-



Fig. 2. Principal Component Analysis (PCA) ordination of vegetation plots in *Lacerta agilis* sites; for vegetation explanations see Table 1.

matic, because plots differed in vegetation cover rather than in taxonomic composition. The PCA first two axes explained 58 % of variation. The first axis (eigenvalue 0.48) could be interpreted as a vegetation cover gradient, and the second (eigenvalue 0.10) – as a vegetation composition gradient. All plots fell into two groups (Fig. 2), and only in respect to the second reflected a composition gradient. Vegetation in both groups was rather similar (Table 1), and both could be separated by relative importance of heath (*Calluna vulgaris*) and grass vegetation. In about 75 % of plots vegetation was dominated by sparse swards of grasses (*Calamagrostis*, *Poa*, *Festuca* etc.), with presence of other herbaceous vegetation and some low shrubs. Plots were located on different soils, some even on peat, where *Lacerta agilis* penetrated edges of drained bogs from neighboring dry habitats. In about 25 % of plots vegetation was more closed, dominated by heath (*Calluna vulgaris*) and small, tufted grasses typical for relatively xeric sites (*Festuca ovina* agg., *Koeleria glauca*, *Nardus stricta*) on sand. Trees were sparse, low, and dominated by *Pinus sylvestris*, *Betula* spp. in both cases. *Lacerta agilis* habitats with heath are typical for Northern Europe, indicating a specific, dry environment with mosaic vegetation pattern (Dent, Spellerberg 1987; Berglind 2005). However, sites, dominated by grasses, may be more important (Stumpel 1988), confirmed also by the present study.

Acknowledgements

The study was supported by the European Social Fund. The author is grateful to all who offered data about *Lacerta agilis* records in Latvia, and to two anonymous referees for their valuable comments on the manuscript.

References

- Andrušaitis G. (ed) 2003. *Red Data Book of Latvia: Rare and Endangered Species of Plants and Animals*. Vol. 5. Fishes, Amphibians, Reptiles. University of Latvia, Institute of Biology, Riga. 144 p. (in Latvian)
- Arnold N., Ovenden D.W. 2002. *Reptiles and Amphibians of Europe*. Princeton University Press, Princeton and Oxford. 288 p.
- Barševskis A., Savenkovs N., Evarts-Bunders P., Daniele I., Pētersons G., Pilāts V., Zviedre E., Pilāte D., Kalniņš M., Vilks K., Poppels A. 2002. *Fauna, Flora and Vegetation of the Silene Nature Park*. Baltic Coleopterology Institute, Daugavpils. 105 p. (in Latvian)
- Berglind S.-A. 2005. *Population Dynamics and Conservation of the Sand Lizard (Lacerta agilis) on the Edge of Its Range*. Summaries of the Uppsala dissertations from the Faculty of Science and Technology, Uppsala. 42 p.
- Čeirāns A. 2002. Reptiles and amphibians of the Gauja National Park, Latvia. *Biota* 3: 17–26.
- Čeirāns A. 2003. Reptiles and anurans of the Kemerī National Park, Latvia. In: Heikkilä R., Lindholm T. (eds) *Biodiversity and Conservation of Boreal Nature*. The Finnish Environment 485. Kainuu Regional Environment Centre, pp. 182–186.
- Čeirāns A. 2004. Reptiles in sub-boreal forests of Eastern Europe: patterns of forest type preferences and habitat use in *Anguis fragilis*, *Zootoca vivipara* and *Natrix natrix*. *Herpetozoa* 17: 65–74.
- Čeirāns A. 2006. Reptile abundance in temperate-zone Europe: effect of regional climate and habitat factors in Latvia. *Russian J. Herpetol.* 13: 53–60.
- Dent S., Spellerberg I.F. 1987. Habitats of the lizards *Lacerta agilis* and *Lacerta vivipara* on forest ride verges in Britain. *Biol. Conserv.* 42: 273–286.
- Edgar P., Bird D.R. 2006. *A Plan for the Conservation of the Sand Lizard (Lacerta agilis) in Northwest Europe*. Convention on the Conservation of European Wildlife and Natural Habitats, Standing Committee 26th meeting Strasbourg, 27030 November 2006. 22 p.
- Fitter R., Fitter A., Blamey M. 1996. *Wild Flowers of Britain and Northern Europe*. 5th Edition. Harper Collins Publishers, London. 352 p.
- Fitter R., Fitter A., Farrer A. 1984. *Collins Guide to the Grasses, Sedges, Rushes and Ferns of Britain and Northern Europe*. Harper Collins Publishers, London. 256 p.
- Gruodis S. 1987. Amphibians and reptiles. In: Sokolov V.J. (ed.) *Ecological Optimization of Agrolandscape*. Nauka Publishers, Moscow, pp. 144–149 (in Russian)
- Jablokov A.V. (ed) 1976. *The Sand Lizard. Monographic Description of the Species*. Nauka, Moscow. 274 p. (in Russian)
- Kalyabina-Hauf S., Milto K.D., Ananjeva N.B., Legal L., Joger U., Wink M. 2001. Phylogeography and systematics of *Lacerta agilis* based on mitochondrial cytochrome B gene sequences: first results. *Russian J. Herpetol.* 8: 148–158.
- Kavacs G. (ed) 1998. *The Encyclopaedia of Latvia's Nature*. Vol. 6. Preses nams, Riga. 598 p. (in Latvian)
- Lipsbergs J., Kačalova O., Ozols G., Rūce I., Šulcs A. 1990. *Popular Red Data Book of Latvia: Animals*. Zinātne, Riga. 191 p. (in Latvian)
- Pētersone A., Birkmane K. 1980. *A Guide to the Plants of the Latvian SSR*. 2nd edition. Zvaigzne, Riga. 762 p. (in Latvian)
- Pikulik M.M., Baharev V.S., Kosov S.V. 1988. *Reptiles of Belarus*. Nauka i Tehnika Publishers, Minsk. 166 p. (in Russian)
- Siliņš J., Lamsters V. 1934. *Reptiles and Amphibians of Latvia*. Valters un Rapa, Riga. 96 p. (in Latvian)
- Sloka J. 1961. *Amphibians and Reptiles of Latvian SSR, Their Importance and Noxiousness*. Academy of Sciences of the Latvian SSR Publishers, Riga. 64 p. (in Latvian)
- Stumpel A.H.P. 1988. Habitat selection and management of the Sand lizard, *Lacerta agilis* L., at the Utrechtse Heuvelrug, Central Netherlands. *Mertensiella* 1: 122–131.

- Trakimas G. 2005. Geographic distribution and status of sand lizard (*Lacerta agilis*) and common lizard (*Lacerta (Zootoca) vivipara*) in Lithuania. *Acta Zool. Lituanica* 15: 372–375.
- Van den Brink P.J., Van den Brink N.W., Ter Braak C.J.F. 2003. Multivariate analysis of exotoxicological data using ordination: demonstrations of utility on the basis of various examples. *Australasian J. Ecotoxicol.* 9: 141–156.

Sila ķirzakas (*Lacerta agilis*) izplatība un dzīvesvietas Latvijā

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Kopsavilkums

Dotā pētījuma mērķis bija apkopot informāciju par sila ķirzakas (*Lacerta agilis*) izplatību un biotopiem Latvijā. Ziņas par sugas izplatību ievāca raksta autors no 1990. līdz 2005. gadam, izmantoti arī ticami citu novērotāju ziņojumi par sugas izplatību dotajā laika periodā. Suga biežāk konstatēta Piejūras zemienē, atsevišķās lielo upju ieleju daļās, kā arī Latvijas dienvidaustrumu daļā. Biotopi (veģetācija) aprakstīti apaļveida parauglaukumos, izmantojot modificētu Brauna-Blankē metodi. Parauglaukumu skaits – 32, to rādiuss 1,5 m lakstaugu stāvam, 5 m – krūmu un 10 m – koku stāvam. Lai identificētu parauglaukumu grupas biotopu klasifikācijai, izmantota galveno komponentu analīze. Veģetācija parauglaukumos bija samērā līdzīga, ap 75 % parauglaukumu dominēja graudzāles, 25 % – virši (*Calluna vulgaris*). Rakstā sniegts arī detalizēts veģetācijas apraksts.