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Age and size stucture of some populations of the lizards *Lacerta agilis boemica* and *L. strigata* from Eastern North Caucasus

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Abstract: Adult and subadult specimens (N=155) from a high-mountain population of *L. agilis* and a foothill population of *L. agilis* and sympatric *L. strigata* from Daghestan were measured for snout-vent length and aged by counting annual layers in their femoral bones. In the foothill populations about 60% of adult males and 80% of adult females were 2-yr-old animals while lizards surviving more than 3 winterings made up 0-20%. Age composition of the high-mountain population was substantially different, being skewed to older age groups. Maximum age for the samples studied was 6-7 years. In L.agilis the adult females from the high-mountain population were on an average larger than those from the foohill population that can be largely attributed to the differences in age composition

Key words: *Lacerta agilis*, *Lacerta strigata*, population age structure, growth rate

INTRODUCTION

The technique for age determination in amphibians and reptiles based on counting annual layers in their bones has been successfully used in many herpetological studies (see references in CASTANET, SMIRINA, 1990). However for European lizards, data on the population age structure are still scarce, particularly for Caucasian taxa. This preliminary paper presents data on age and size composition of three populations of *Lacerta agilis* and a related sympatric species, *L. strigata* from the eastern North Caucasus.

L. agilis is a widespread species distributed over much of the temperate zone of the Palearctic; in the eastern North Caucasus it is presented by a distinct subspecies, *L. a. boemica* (BISCHOFF, 1988). *L.strigata* inhabits the eastern Caucasus with adjacent parts of Turkey and Iran (DAREVSKIJ, 1984).

MATERIAL AND METHODS

Samples from the following three *Lacerta* populations were examined: I- *L .agilis*, Kuli (high-mountain Daghestan, 42 00'N, 47 15'E), 1900 m above sea level; II- *L. agilis*, Sergokala, (foothill Daghestan, 42 30'N, 47 40'E), 600 m a.s.l.; III- *L. strigata*, Sergokala, the same collection site as for *L .agilis* (II). Sample I was collected during August 1989 and July 1990, and samples II and III during 11-14 June 1982.

In total, 155 specimens were used in this study. All the lizards were measured for snout-vent length (SVL). The adult specimens (N=81) and a few largest subadults were examined foraging by counting numbers of visible resting lines (LAGs) on transversal sections of the middle part of the femur diaphysis. Diameters of annuli were measured with ocular-micrometer under a light microscope. As the contours of the bone sections deviate from a circle, means of the minimal and maximal diameters of every annulus (measured in three sections from every specimen) were used to estimate an annual increment of bone width.

For nearly all the femurs examined, LAGs were well defined providing precise age estimation. Only two femurs gave some difficulties in age estimation but the possible error did not exceed 1 year.

RESULTS

Age and size structure

Age distributions in the samples of adults from the three lizard populations are presented in Fig.1. It shows clearly that the high-mountain *L. agilis* population differs from both the foothill populations by a large proportion of older animals. For the females, the ratio of 2-yr-old animals to 3-and-more years old animals differs significantly between samples I and II (X^2=12.97, df=1, P<0.001) and between samples I and III (X^2=10.59, df=1, P<0.01).

Size (SVL) distributions of the samples studied are shown in Fig.2. It exhibits a rather clear separation of the yearlings from the adults (2-and-more years old lizards) for SVL in the samples of *L. agilis* and sympatric *L. strigata*

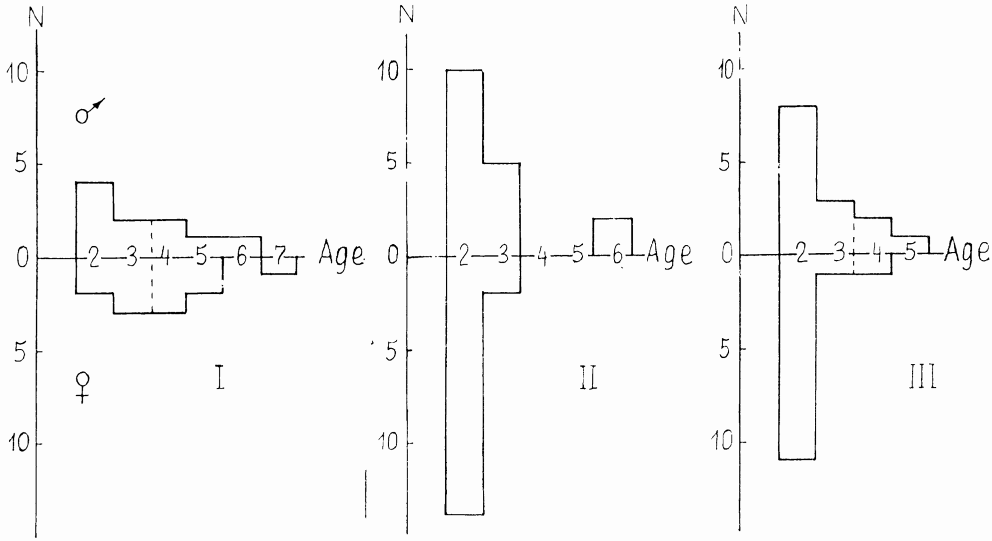

Figure 1: Age distributions for the samples of adults from three Lacerta populations.

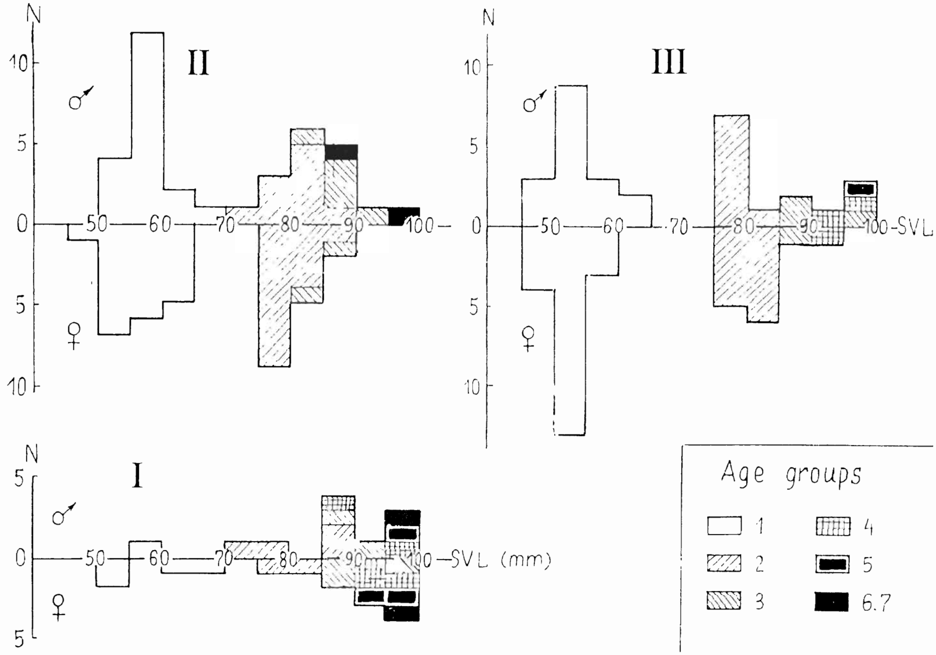

Figure2: Size (SVL) distributions for the samples from three Lacerta populations. (Age groups are indicated by different shadings).

collected in early summer (11-14 June 1982).Fig.2 also indicates a relatively small proportion of yearlings in the high-mountain *L. agilis* population, as compared to the foothill populations. The high-mountain population is also characterized by a relatively high percent of larger animals (L>90mm)(Fig.2); when the sexes are combined, this difference is significant at $P<0.001$ ($X^2=15.07$, df=1) between samples I and II, and at $P<0.01$ ($X^2=7.08$, df=1) between samples I and III.

	L. agilis Kuli	*L. agilis* Sergokala	*L. strigata.* Sergokala
♂	0.882 (n=10)	0.879 (n=17)	0.975 (n=14)
♀	0.972 (n=11)	0.806 (n=16)	0.852 (n=13)

Table 1 Correlation (r) between SVL and femur diaphysis diameter.

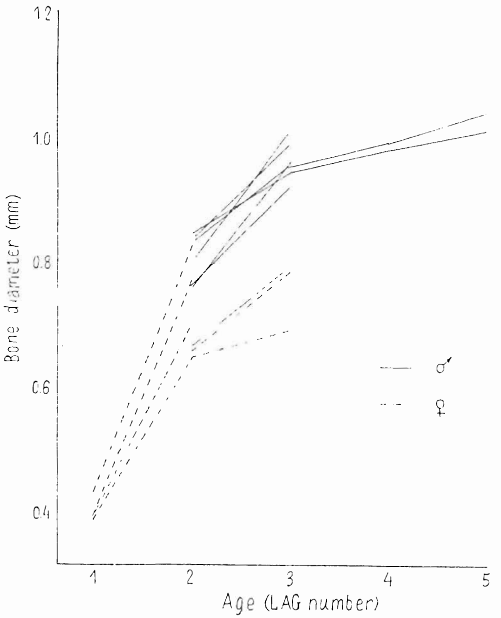

Figure 3: Annual increases of thickness of the femoral bone in individual specimens of *L. agilis* from Kuli.

Relationship between bone diameter and SVL

Correlation between diameter of the femur at the diaphysis level and the SVL is consistently higher than 0.8 (Table 1). Consequently, results for the growth rate of the femur thickness can serve as a rather good estimation of the body growth rate. Such a high correlation between the tubular bones thickness and SVL has also been demonstrated within several taxa of the lacertid genus *Gallotia* (CASTANET, BAEZ, 1991). Similar result was also obtained for a toad, *Bufo bufo* (SMIRINA, 1983) and a frog, *Rana temporaria* (RYSEN, 1988 in CASTANET, BAEZ, 1991).

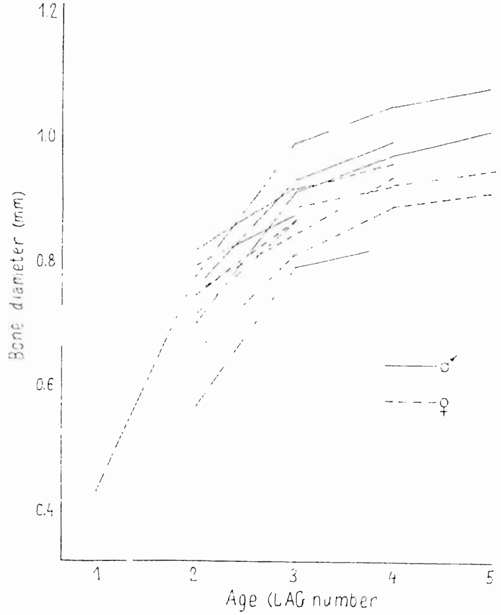

Figure 4: Annual increases of thickness of the femoral bone in individual specimens of *L. agilis* from Sergokala

Growth rate

Individual growth rates as expressed by annual increments of femoral bone thickness in the three *Lacerta* populations are presented in Fig.3, 4, and 5. As can be seen from these figures,individual growth curves show no clear differences between the populations studied. These data suggest that a higher proportion of larger adults in the high-mountain *L. agilis* population (Fig.2) can be attributed rather to its high longevity than to differences in growth rate.

According to our data, males tend to grow somewhat faster than females. Annual growth increments are largest for the period between 1st and 2nd winter. Then growth becomes slower, especially in lizards surviving 3-and-more winterings (Fig.3-5).

In all three populations under study many individuals had double resting lines. For females such individuals were more frequent in *L. agilis* than in *L. strigata* ($p<0.05$: $X^2=4.9$ and 6.2 for

Subspecies	age (number of survived winterins)					
localities and samples	2	3	4	5	6-7	8-11
L. a. boemica						
(1) Kuli, highland Daghestan, N=21	28.6	23.8	23.8	14.3	9.5	-
(2)Sergokala, foothill Daghes.,N=33	72.7	18.2	-	-	6.1	-
L.a. chersonensis						
(3) Uman, Ukraine, N=42	66.7	23.8	9.5	-	-	-
L.a. exigua, SW Altai (South Siberia)						
(4) Locality 1, N=282	46.5	40.7	9.9	2.9	-	-
(5) Locality 2, N=267	38.2	44.2	13.1	4.5	-	-
L. a.. agilis						
(6) Nijmegen, Netherlands, N=498	38.0	29.5	13.5	8.6	6.4	4.0

Table 2: Age frequency distribution (%) in the samples of adult specimens (sexes combined) from different populations of *Lacerta agilis*. Sources of data: (1.2) ours. (3) SMIRINA, 1974. (4) TURUTINA, 1977. (5) STRIJBOSCH & CREEMERS, 1988. Method: (1-5) bone layers counting. (6) a long-term mark-recapture study.

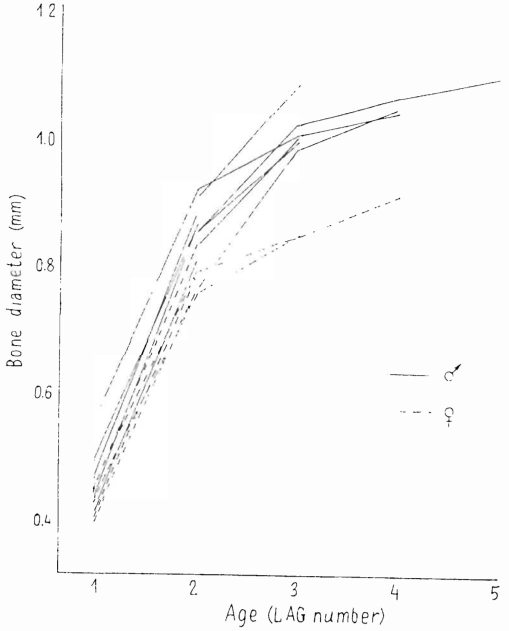

Figure 5: Annual increases of thickness of the femoral bone in individual specimens of *L. strigata* from Sergokala.

comparisons between samples I and III, and between samples II and III, respectively).

DISCUSSION

Higher mean longevity and body size found in the high-mountain *L. agilis* population as compared to both the foothill populations of *L. agilis* and *L. strigata* is in accordance with data on *L. strigata* from Armenia where high-mountain and foothill populations have been contrasted (MELKUMYAN, 1983; LEDENTSOV, MELKUMYAN, 1987). This trend was also shown for high-altitude or northern populations of other lizards (BALLINGER, 1979), newts (e.g. CAETANO, CASTANET, 1993), anurans (e.g. ESTEBAN, 1990; ISHCHENKO, LEDENTSOV, 1993). For body size, however, the opposite tendency (larger SVL at a lower altitude) was also reported for a frog (Rana macrocnemis) and a lizard (*Stellio caucasius*) (LEDENTSOV, MELKUMYAN, 1987).

Table 2 contrasts our data on the age

composition of the North Caucasian populations of *L. agilis* with the data available from a few other *L. agilis* populations. As can be seen from Table 2, a common feature of the presented age compositions is that most of adults are 2 or 3 years old animals, individuals older than 5 years being rather rare. It seems notable that besides the high- mountain Daghestan population the population from the Netherlands is also characterized by a higher proportion of older individuals (Table 2).

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