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Determination of sex ratio in juvenile sand lizards (*Lacerta agilis*)

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Sex determination is often a problem in juvenile sand lizards (*Lacerta agilis*) because of the lack of sexual colours and differences in body proportions. A difference in the number of ventralia between males and females was described by Regamy (1935). He counted the ventralia from the first sternalia to the last ventralia, and described 30-32 ventralia for females and 27-29 for males. Comparative considerations of pholidosis were omitted from his chapter of sexual differences in juveniles, although other aspects were discussed very thoroughly. Wermuth (1955) and Bauwens and Thoen (1982) described methods for sex determination depending on differences in the number of ventralia in

Lacerta vivipara. Lecomte et al. (1992) published a method for sex determination in this species, and noted that the number of ventralia is manifested at the time of hatching. According to the results of Bauwens and Thoen (1982), the number remains constant during ontogeny.

Samples of *L. agilis* were taken from two populations in the south-west of Halle (Saale), Germany, which are presumably isolated from one another by the river Saale. Ventralia were counted on the second rows from the right and the left (the 2nd and 5th ventralia row) in a longitudinal direction using a magnifying glass (5-10×). The scales from the second sternalia to the last but one ventralia were counted to ascertain the number of ventralia. After substracting the first sternalia and the last ventralia (because the counting of scales is then easier to manage), a count of 28 to 30 for females and 25 to 27 for males should be expected.

Adults showed significant differences in ventralia counts (table 1, fig. 1). Between the 2nd sternalia and last but one ventralia, males ($n = 90$) had 24-27 and females ($n = 107$) 28-32 scales. Five per cent of the females had fewer then 28 ventralia and 10% of the males had more than 27 ventralia (see "outer values%" for left and right ventralia rows of both sexes in table 1). The proportional variability of the distribution of the number of ventral scales was the same for both sexes (cv% = 0.04), but the range for the males was more restricted, because the count for females depended on a difference of 5 scales whereas the scales of the males were counted on a difference of 4 scales. The more restricted range of the males means that 5% have to be added to the account of juveniles that were assigned as males. For sex determination of juvenile samples, this procedure is necessary to adjust the greater range of scales of the females. The estimation of sex ratio in the sample of adults by taking the scales of the sex specific scale range into account (individuals with a combination of 28 and 27 ventral scales are excluded) is 1.3 : 1 f/m (102 : 81—by subtracting the outer values: > 27 for males and < 28 for females, see table 1). The adjusted ratio results in a sex ratio of 1.2 : 1 f/m (102 : (81 + 5%) = 120 : 85.04).

Table 1. Differences in number of ventralia between males and females. Limits of number of scales for each sexus are given in min and max.

males	LV	RV	LV + RV/2	females	LV	RV	LV + RV/2
$n = 90$				$n = 107$			
min	24	24	24.5	min	25	26	25.5
max	30	30	30	max	31	32	31
mean	26.3	26.6	26.5	mean	28.9	29	29
SD	1.07	1.01	0.97	SD	1.06	1.08	1.01
upper limit	27	27	27	lower limit	29	29	28
cv%	0.04	0.04	0.04	cv%	0.04	0.04	0.03
t	4.75			t	4.43		
P	< 0.001			P	< 0.001		
outer values	9	9	8	outer values	6	5	8
outer values%	10	10	8.9	outer values%	5.6	4.7	7.5

LV = left ventralia row, RV = right ventralia row, LV + RV/2 = mean between LV and RV, SD = standard deviation, cv% = coefficient of variation.

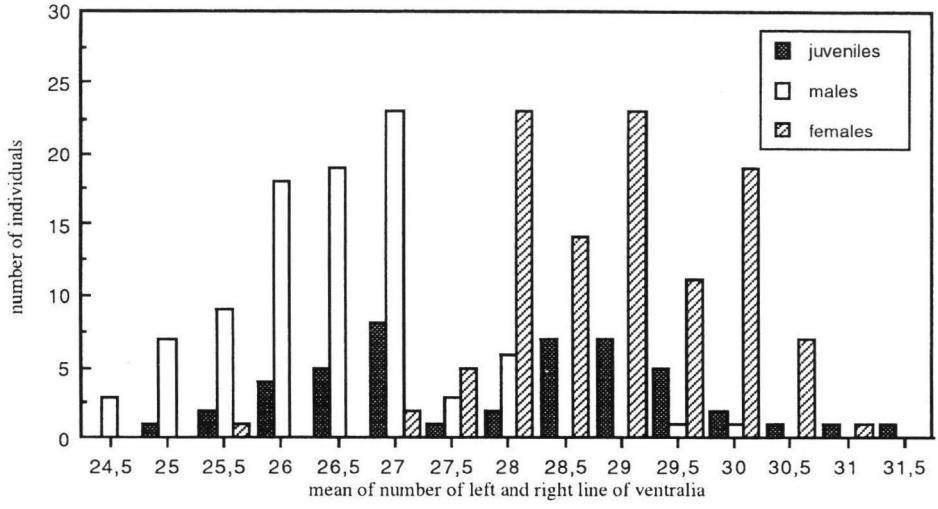

Figure 1. Numbers of individuals of females, males and juveniles, who's average number of ventralia between the second sternalia and the last but one ventralia are arranged on the abscissa.

The proportion of sexes in a sample of juveniles can be determined by the ratio of counts of the ventralia of the individuals. Juveniles with a combination of 27 and 28 scales by counting the left and right ventralia line were not taken into account because it is impossible to assign them to one of both sexes. This combination occurred in both sexes of adults in a ratio of 1 : 1.27 juveniles showed 24-27 scales and were assigned as males, and 31 juveniles with 28-32 scales were assigned as females. Because the range of scales was lower in males (4 scales) than in females (5 scales) as described above, 5% of the individuals assigned as males had to be added to the number of individuals assigned as males. So the sex ratio of the sample is $31 : (27 + 5\%) = 1.1 : 1$ f/m, which corresponds to the proportional ratio of the adults, being 1.2 : 1 f/m.

It could be shown that the occurring sex-specific ratio of differences in ventralia row numbers are equal in adults and juveniles. Both females and males show sex-specific scale numbers of high significance level ($P < 0.001$). These facts were used to determinate the sex ratio in juveniles of one population. For the application of this method some remarks have to be made. There is no knowledge about differences in sex dependent mortality of juveniles. Strijbosch and Cremers (1988) reported a higher life expectancy for females than for males of *Lacerta agilis* and *Lacerta vivipara*. That can be one reason why the account of adult females is little higher than the account of adult males. Nevertheless this method is statistical and based on the assumption that the mortality is equal for juveniles of both sexes. The proportional equality of the variation of scale numbers of adults compared with juveniles is an indication, that this assumption is correct, but it has to be proved first. The main points are that a constancy in the number of scales during ontogeny can be assumed as mentioned above and that

the number of ventral scales of individuals are statistical sex-specific. But the range of possible deviations in sex-specific ventral scale numbers within populations has to be proved to ensure the application of this method.

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Reproductive cycle and clutch size in female sharp-snouted rock lizards, *Lacerta oxycephala*

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The sharp-snouted rock lizard, *Lacerta oxycephala* Dumeril and Bibron, 1839, is a peculiar member of the phylogenetically old lacertid group Archeolacerta. It is a stenoendemic Balkan species, restricted in its range to a narrow zone along the Adriatic coast from the river Krka to the northwestern part of Albania, including also some off-shore islands. This relatively small lizard is distinct in morphology from other Balkan lacertids by having a flattened short body, with a pointed snout, and blue underparts. In an ecological sense, *L. oxycephala* is peculiar as being the most petricole specialist among Balkan lacertids, inhabiting mostly sunny cliffs, rock-pavements, walls and similar habitats.

