

REPRODUCTIVE CYCLE IN THE COMMON WALL LIZARD (*PODARCIS MURALIS*) FROM BELGRADE

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Abstract - We studied male and female one-year reproductive, fat body and liver cycle of the common wall lizard (*Podarcis muralis muralis*) from the urban and suburban localities of Belgrade. The minimum size at which females attain sexual maturity was between 49.78 and 51.25 mm of the snout-vent length. Vitellogenesis started at the end of March. The size and number of vitellogenic follicles varied considerably during the season. Increase in the female size leads to a significant increase in number but not in size of vitellogenic follicles. Females with oviductal eggs were found from late May to late July. Two clutches with mean size of 3.5 ± 0.31 were laid in 1994. We found a significant positive correlation between female size and oviductal clutch size, while partial correlation between SVL and mean egg volume, as well as between clutch size and mean egg volume was insignificant. Relative oviductal clutch mass had the mean value of 0.17 ± 0.01 , and was not correlated with female size. Testicles and epididymides exhibited maximal weight during April-June, and minimum in late July. The increase in male SVL lead to a significant increase in testicular and epididymal mass. Viable spermatozoa were produced from March to July. Fat bodies and liver of males were the smallest during the mating period while female fat bodies and liver decreased in weight during vitellogenesis. Mass of fat bodies and liver were significantly positively correlated with SVL in both sexes.

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INTRODUCTION

Reproductive cycle of lizards has been frequently studied in recent years, because reproduction is perhaps the most fundamentally important process in life history of an organism (Gills and Balinger 1992). Considerable intraspecific temporal and geographic variations in reproductive and other life history traits were reported (Dunham *et al.* 1988). Comparisons among geographically separated populations of wide-ranging species are particularly useful in elucidating variation in reproductive characteristics resulting from proximate causes, differing selective pressures or varying phylogenetic backgrounds (Gills and Balinger 1992). Therefore, *P. muralis* as a widespread and abundant species is a very good object for these analyses.

The common wall lizard (*Podarcis muralis*) is a small, diurnal, insectivorous lizard found over a wide range in central and southern Europe where it occupies various habitats. It is a climbing species that behaves like a typical heliotherm (Avery 1976). This oviparous lizard, attains maturity in its second year (Barbault and Mou 1988), reproduces one to three times *per year* and has a distinct annual reproductive cycle (Saint Girons and Duguy 1970; Kwiat and Gist 1987; Barbault and Mou 1988; Bejaković *et al.* 1996). This species shows a substantial morphological and reproductive variation among its popula-

tions. Apart from this, recent studies on this species have provided data on the reproductive traits in females (Saint Girons and Duguy 1970; Kwiat and Gist 1987; Barbault and Mou 1988; Brana *et al.* 1991; Capula *et al.* 1993; Bejaković *et al.* 1996). On the other hand, investigations of male reproductive cycle are scarce (Saint Girons and Duguy 1970; Kwiat and Gist 1987), as well as of fat bodies cycle (only in females: Bejaković *et al.* 1996) or liver cycle. This study presents the data on the reproductive, fat body and liver cycle in both sexes in Belgrade population of *P. muralis* during 1994. Our aim was to provide relevant data for further analysis of the variation in reproductive characteristics of this wide-ranging species.

MATERIAL AND METHODS

Study Area

Specimens were collected from several localities with distance range of 4-5 km. They were collected from walls, stone fences, stony and rubbish heap, along footpaths, stairways, field parameters and hedges. Belgrade is situated at a hilly terrain (altitude 75-150 m) in moderate-continental climate region. Belgrade is a large city, the capital of Yugoslavia and all sampled localities are exposed to huge anthropological influence and various pollutants.

Field and Laboratory Methods

Lizards were collected by noosing. Sampling occurred at regular monthly intervals from late March to late October in 1994. We captured 197 specimens (86 females, 84 males, 18 juvenile females, 9 juvenile males). All lizards caught were transported live to the laboratory. A number of males were immediately measured, weighed and dissected to remove epididymides. Sperm smears were prepared by crushing epididymis on a slide. Slides were then checked for the presence of spermatozoa.

Other specimens were killed by quick-freezing and maintained frozen until processed. Sampled individuals were measured and weighed after thawing, and dissected before being stored permanently in 70% alcohol. Specimens were deposited in the Georg Džukić's herpetological collection (Institute for Biological Research, Belgrade).

Body measurements included snout-vent length (SVL) and mass. During autopsy, the following measurements were taken: for females - number of quiescent and vitellogenic ovarian follicles and diameter of the largest ones in each ovary; number, length, width and mass of oviductal eggs and for males - mass of testicles and mass of epididymis. The mass of fat bodies and liver were taken for both sexes. Ovarian follicles were measured with dial calipers under a stereoscopic dissecting microscope. Linear measurements were taken to the nearest 0.01 mm, mass measurements were performed with an electronic balance (accuracy 0.001 g).

The estimate of the egg volume ($V=4/3\pi a^2b$, where a is half the shortest diameter and b half the longest diameter) was taken as an overall measure of the oviductal egg size. The relative clutch mass (RCM) is expressed by the ratio of the clutch mass and the total body mass including the clutch (Vitt and Congdon 1978). Females containing vitellogenic follicles and/or oviductal eggs were considered as active in reproduction.

Minimum size at maturity was determined by the smallest female containing enlarged vitellogenic follicles. The reproductive condition of each female was established from the presence or absence of vitellogenic follicles in ovaries, oviductal eggs, and internal marks of recent oviposition (widened oviducts indicated postparturiency). A simultaneous occurrence of oviductal and vitellogenic follicles was used as the evidence that lizards produce at least two clutches *per* season.

Statistical analysis

One-way analysis of variance (ANOVA) was used to assess differences between means. An analysis of covariance (ANCOVA), with SVL as covariate, was used

when the variable tested was influenced by body size. An index of SVL -adjusted dimensions of testicles and epididymis was calculated using residuals from the least-squares regression line between organ and SVL. Statistical analyses were done by various SAS procedures (SAS Institute, Inc. 1991).

RESULTS AND DISCUSSION

Attainment of Sexual Maturity

Immature females of the common wall lizard were characterized by transparent to white follicles up to 2 mm in diameter. Follicles larger than 3 mm showing appearance of vitellogenesis were used as an indication of the first sign of reproductive activity of females. The snout-vent length (SVL) of the smallest sexually mature female (carried vitellogenic follicles) was 49.78 mm (the March sample). However, the largest immature female found (June sample) was somewhat bigger (SVL=51.25 mm). Hence, SVL length between 49.78-51.25 mm can be considered as the minimum size range for attainment of sexual maturity in this population of *P. muralis*. This range is similar to that reported by Edsman (1986) and Capula *et al.* (1993), but much smaller than those observed in some other populations of this species (Barbault and Mou 1988; Bejaković *et al.* 1996).

Annual Oviposition Frequency

All adult females from March and April samples had vitellogenic follicles. Most individuals (75%) from May sample simultaneously had vitellogenic follicles and oviductal eggs, and one female had enlarged oviducts (indicated recent oviposition) and vitellogenic follicles (Table 1). In the June sample, majority of females

Table 1. Distribution of *P. muralis* female reproductive conditions through the season in 1994. Reproductive status of females were categorized according to the presence of: (1) quiescent follicles, (2) vitellogenic follicles, (3) oviductal eggs, (4) postparturiency, (5) simultaneous occurrence of oviductal eggs and vitellogenic follicles, and (6) simultaneous occurrence of postparturient sign and vitellogenic follicles. N-sample size, % -percentage of reproductive active females, immature females were omitted.

Sample	N	(1)	(2)	(3)	(4)	(5)	(6)	%
March	6		6					100
April	8		8					100
May	8			1		6	1	100
June	10			1		3	6	100
July	12	2			7	1	2	25
August	16	5	2		9			12.5
Sept	14	10	3		1			21.4
October	12	5	3		4			25

(60%) had simultaneous occurrence of postparturient signs and vitellogenic follicles, and 30% had vitellogenic follicles plus oviductal eggs. These data indicate a presence of at least two clutches in this season. Both May and June samples contained only one female with oviductal eggs. The largest diversity of reproductive conditions was observed in females from July sample, where 25% individuals were active in reproduction, 60% had postparturient signs, and 15% did not show internal signs of reproductive activity.

In the last three samples (August to October), majority of females finished their reproductive activity for the season (they had postparturient signs and quiescent follicles). However, some females had a few small vitellogenic follicles which would, probably, become atretic.

On the basis of these data, we concluded that Belgrade population of this species had two clutches in 1994. Standard frequency of two clutches *per* season and possibility of the third clutch in some older females with more energy stores, were pointed out by several authors (Saint Girons and Duguay 1970; Kwiat and Gist 1987; Baurbault and Mou 1988; Capula *et al.* 1993).

We can conclude that the most females from Belgrade population laid the first clutch between late-May and mid-June, and the second between late-June and mid-July.

Some delayed oviposition intervals in regard to those observed by Barbault and Mou (1988) were probably caused by climate differences between these two examined sites and/or by inadequate environmental conditions for lizard reproduction in the first quarter of 1994 (long, cold winter and three weeks rain interval in April). Thus, the minor differences in the timing of reproductive events seem adequately explained on the basis of thermal differences between the two areas, and do not reflect life-history adaptations to a different habitat (Kwiat and Gist 1987). Also, reproductive output varies between years in the same population and is correlated with thermal and hydric conditions of the environment (Vitt 1982 and references therein).

Finding females that carried vitellogenic follicles in late March sample, leads to the conclusion that they left hibernation several weeks earlier, *i.e.* in the beginning of March. The presence of female with widened oviducts in the May sample (sign of postparturition) points to the early April as the time of the beginning of copulation. The reproduction peak must have happened in June. Reproduction finished in August, although considerable number of females from July sample (about 60%) ended their reproductive activity for that season.

Vitellogenic Follicle Size through Season

We found significant differences between the samples in the number of vitellogenic follicles from right (ANCOVA, $F=10.42$, $P<0.05$) and left ovary (ANCOVA, $F=9.86$, $P<0.05$), as well as in the size of the largest vitellogenic follicle from right ovary (ANCOVA, $F=10.13$, $P<0.05$) and left ovary (ANCOVA, $F=8.77$, $P<0.05$). (Figs. 1. and 2.).

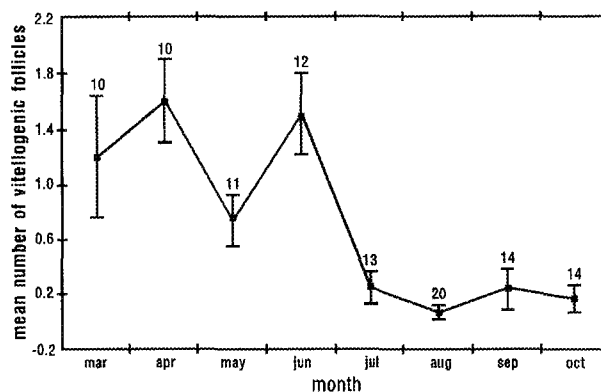


Fig. 1. Monthly changes (mean S.E. and sample size) in the number of vitellogenic follicles from left ovary.

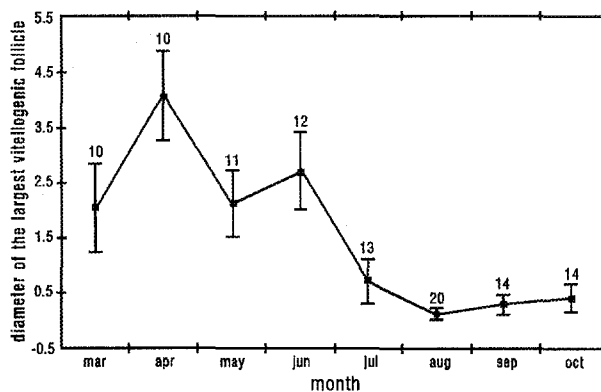


Fig. 2. Monthly changes (mean S.E. and sample size) in diameter (mm) of the largest vitellogenic follicle from left ovary.

There was a significant positive correlation between the SVL of females and the number of vitellogenic follicles from left ovary in the samples from March to July ($P<0.05$, in all cases) and positive, but not significant in other ones. This latter result could be ascribed to the fact that in the last four samples we found only a few females with a few small vitellogenic follicles. Increase in number of vitellogenic follicles correlating with an increase in SVL was found in some lizards (Castilla and Bauwens 1989; Howland *et al.* 1989) but not in others (Bejaković *et al.* 1995).

Correlation between the SVL of females and the size of the largest vitellogenic follicle from left ovary was positive in all samples, but significant only in April ($r=0.74$, $P<0.05$) and May ($r=0.64$, $P<0.05$) samples. Also, we found that the correlation between the number of vitellogenic follicles and the size of the largest one from left ovary was positive and significant in all samples except in April sample ($r=0.61$, $P>0.05$).

In Belgrade population of *P. muralis* increase in female body size leads to a significant increase in number, but not in the size of vitellogenic follicles. This correlation was not calculated for other populations of this species, so we can not conclude if this is a general trend in this species.

Oviductal clutch Characteristics

Oviductal eggs with completely formed shell were found in examined *P. muralis* individuals in the May (7 off 8 females), June (4 off 10 females) and July sample (1 off 12 females).

The smallest female which carried oviductal eggs was 50.76 mm of SVL. This was much smaller SVL than those noticed in conspecific populations, *i.e.* 57 mm for the population in Southwestern France (Barbault and Mou 1988) and 59.28 mm for that from the Skadar Lake region, (Bejaković *et al.* 1996).

Females with oviductal eggs had, on the average, 56.88 \pm 1.11 mm in SVL, and the clutch size of 2 to 5 eggs (mean \pm S.E. = 3.5 \pm 0.3). A relative clutch mass of oviductal eggs ranged from 0.14 to 0.22, with the mean value of 0.17 \pm 0.01. Other characteristics of oviductal clutch and eggs are shown in Tables 2 and 3.

Table 2. Oviductal clutch characteristics. Number of individuals = 12; number of oviductal eggs = 42.

	range	mean \pm S.E.
SVL (mm)	50.76 – 64.47	56.88 \pm 1.11
Body mass (g)	2.843 – 5.709	4.113 \pm 0.225
Clutch size	2 – 5	3.5 \pm 0.31
Clutch volume (mm ³)	347.20 – 1029.42	763.84 \pm 64.67
Mean egg volume (mm ³)	173.67 – 322.70	222.19 \pm 9.31
Relative clutch mass	0.141 – 0.223	0.174 \pm 0.012

The range and the mean of oviductal clutch size found in this study is considerably smaller than that obtained for most other *P. muralis* populations (Barbault and Mou 1988; Brana *et al.* 1991; Capula *et al.* 1993; Bejaković *et al.* 1996) and is close only

to an introduced population in Ohio-USA (Kwiat and Gist 1987). These authors noted that the difference in the clutch size among intraspecific populations reflects environmental extremes. They also explained that smaller clutch size resulted from the smaller size of reproducing females (positive relationship between the clutch size and body size occurs often in lizards; *e.g.* Dunham *et al.* 1988) and may also reflect the pressures of high-density population with a finite habitat and food availability.

Table 3. Characteristics of oviductal eggs. N = 42.

	range	mean \pm S.E.
Egg length (mm)	8.49 – 13.11	10.77 \pm 0.16
Egg width (mm)	5.50 – 7.30	6.20 \pm 0.06
Egg volume (mm ³)	144.03 – 348.02	218.53 \pm 6.20
Egg mass (g)	0.151 – 0.280	0.204 \pm 0.004

Reproductive females from the Belgrade population were also smaller than those from populations mentioned before. It is maybe one of the reasons for their smaller clutch size. Second reason we can find in a potential error caused by small sample size (only 12 out of 86 females carried oviductal eggs). *P. muralis* is known as a species with large variation in clutch size and with the highest frequency of smaller clutches (approximately with 4 eggs; Bejaković *et al.* 1996).

A significant positive correlation was observed between female size and the number of oviductal eggs ($r=0.79$, $P<0.05$), as found earlier in most lizard species (*e.g.* Vitt 1982; Bauwens and Verheyen 1987; Dunham *et al.* 1988; Castilla and Bauwens 1989; Gillis and Ballinger 1992; Marco and Perez-Mellado 1998), and other *P. muralis* populations (Kwiat and Gist 1987; Barbault and Mou 1988; Brana *et al.* 1991; Capula *et al.* 1993), except for Skadar Lake population (Bejaković *et al.* 1996). A correlation between female SVL and total oviductal clutch volume was insignificant ($r=0.55$, $P>0.05$) similar for Skadar Lake population (Bejaković *et al.* 1996). A significant negative correlation between SVL and the mean egg volume *per* female was found ($r= -0.58$, $P<0.05$). Partial correlation between these variables, with clutch size held constant, was also negative but non-significant ($r= -0.56$, $P>0.05$). Partial correlation between the oviductal clutch size and the mean volume of oviductal egg, with SVL held constant, was not significant ($r=0.27$, $P>0.05$). The same insignificant partial correlation among these three reproductive variables were found in some other lizards (Castilla *et al.* 1991; Bejaković *et al.* 1995, 1996).

Also, there was an insignificant correlation between egg size and SVL, while the correlation between SVL and clutch size was positive and significant in populations of *Podarcis taurica ionica* (Chondropoulos and Lykakis 1983). These authors concluded that increase of SVL is associated with the increase of clutch size but not the egg size. Therefore, this conclusion is also acceptable for our population of *P. muralis*. Sinervo (1990) assumed that one benefit of producing small eggs is that they incubate faster and hence hatch earlier than bigger ones. This is a possible explanation why smaller females do not channel their reproductive investment into producing fewer but larger eggs, but more of the smaller ones (Castilla *et al.* 1991). Furthermore, a low level of competition, or a high level of predation of a type not affected by juvenile size, may press for a strategy of producing many small eggs. The production of a large number of small eggs may be adaptive also in coarse-grained patchy environments, or in those changing in time. As the environment becomes less stable, selection favors greater fecundity rather than survivorship (Frankenberg and Werner 1992 and references therein).

Relative oviductal clutch mass was much lower than the values for lacertids (0.32 - Dunham *et al.* 1988), for some other Balkan lizards: *Podarcis taurica* (Chondropoulos and Lykakis 1983), *P. melisellensis*, *Lacerta oxycephala*, *Algyroides nigropunctatus* (Bejaković *et al.* 1996), and for some *P. muralis* populations (Brana *et al.* 1991; Bejaković *et al.* 1996). Lower RCM values in Belgrade population are probably caused by small number and mass of oviductal eggs, in contrast to *e.g.* population from Spain (Brana *et al.* 1991) where females were lighter in built, but had larger clutches with heavier eggs. Also, small sample size of females with oviductal eggs in Belgrade population should be taken into consideration.

RCM is useful in making comparisons of reproductive investment *per* clutch (Gillis and Ballinger 1992). Vitt and Price (1982) pointed out to the fact that RCM may vary among populations of the species due to resource availability or geographic variation in escape tactics. No correlation was found between the female size and RCM ($r=0.10$, $P>0.05$). Insignificant correlation between these two variables was also observed in some other lizard populations (*e.g.* Brana *et al.* 1991; Bejaković *et al.* 1995).

Fat Body and Liver Cycle

Fat body and liver mass of males and females in this population are shown in Table 4. Fat body mass (FBM) and liver mass (LM) of both sexes expressed a clear seasonal cycle (Figs. 3. and 4.). The fat bodies in

individuals of both sexes were the lowest in May, began to be deposited in June and reached the peak in September. LM of females was also the lowest in May, while that of males had minimal value in June. The highest values of this parameter in both sexes were recorded in September sample.

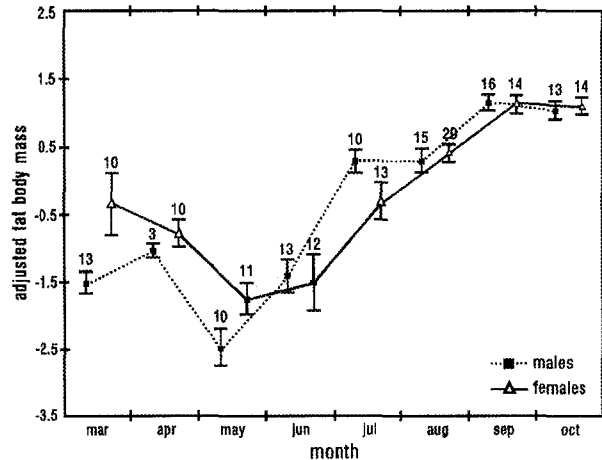


Figure 3. Monthly changes (mean S.E. and sample size) in SVL adjusted fat body mass in male and females of *P. muralis* throughout the activity period.

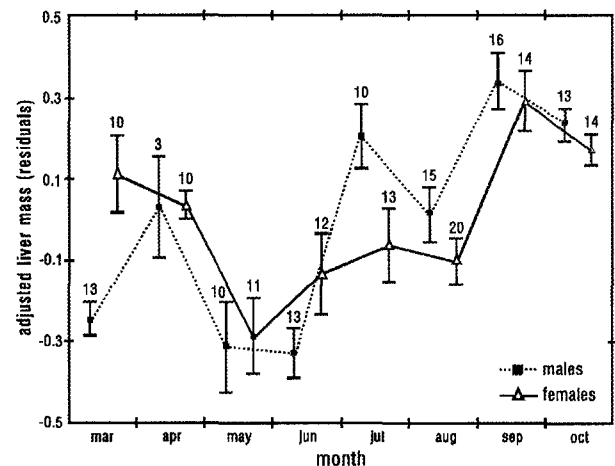


Fig. 4. Monthly changes (mean S.E. and sample size) in SVL adjusted liver mass in male and females of *P. muralis* throughout the activity period.

Significant positive correlation between SVL and FBM was found in both sexes (females $r=0.48$, $P<0.05$, males $r=0.24$, $P<0.05$), and between SVL and LM, as well (females $r=0.69$, $P<0.05$, males $r=0.55$, $P<0.05$). Positive relation between SVL and FBM was also detected in other lizard species (Vitt 1982; Castilla and Bauwens 1990; Gallan 1996).

There were significant differences in FBM and LM among the samples in both sexes (ANCOVA for females FBM with SVL as covariate, $F=31.34$, $P<0.05$ and for

males $F=48.48$, $P<0.05$; ANCOVA for females LM with SVL as covariate, $F=5.97$, $P<0.05$ and for males $F=15.03$, $P<0.05$).

A significant difference in FBM among sampling periods was determined for other lacertids (Castilla and Bauwens 1990; Castilla *et al.* 1991; Bejaković *et al.* 1995, 1996; Galan 1996). The fat body cycle was closely connected with the timing of reproductive events in both sexes. Females fat bodies decrease throughout the reproductive season, as observed for many lizards species in temperate zone (Castilla and Bauwens 1990; Galan 1996 and references therein). Lipids stored in fat bodies contribute the energy for the development of ovarian follicles. However, these lipid stores are useful mainly in the first clutch, and then (as can be seen from Fig. 4), mass of fat bodies starts to increase even during reproductive season. Therefore, the energy required to vitellogenesis in later clutches seems to be acquired from food consumed during that period (B r a n a *et al.* 1992).

The fat body stores of males show an abrupt decrease at the beginning of reproductive activity. An increase in mass of fat bodies in Belgrade population males in March sample is presumably caused by small sample size. Fat bodies retained low mass during the mating period. As pointed out by B r a n a *et al.* (1992), fat body stores of males seem to be used to support behavioral activities associated with reproduction at the beginning of the activity season (the possession and defense of territory, searching for and guarding a mate, and courtship during this period) more than for gonadal recrudescence. As shown in Fig. 3., increase in fat body stores already starts in June, and shows a drastic increase during July, when reproductive season comes to an end. Reduction in mating activities, and probably rich diet apparently influence enlargement of fat bodies during that period.

Until now, annual variation in liver mass has been rarely examined. In our study, liver mass shows similar variations during the season just as fat body mass (Fig. 4). An increase in liver mass in March sample males is, probably, again caused by small sample size. If we take into consideration that liver is an important stock of glycogen and lipids in an organism, we can conclude that it plays the same role in reproductive cycle as fat bodies. However, an abrupt decrease of liver mass in both sexes (more distinct in males) during August requires further investigations.

Male reproductive cycle

Masses of testicles and epididymides of all sampled males are presented in Table 4. Testicles and epididymides were the heaviest in April, and the lightest in July (Fig 5).

Table 4. Fat body and liver mass (range, adjusted mean \pm SD) in males and females and mass of testicles and epididymis in males. N- sample size. Juveniles are included.

	N	range	adjusted mean \pm SD
female SVL (mm)	104	37.52 - 64.47	54.73 \pm 5.21
female fat body mass (g)	91	0.002 - 0.356	0.094 \pm 0.091
female liver mass (g)	104	0.030 - 0.444	0.186 \pm 0.090
male SVL (mm)	93	40.80 - 67.56	57.98 \pm 5.46
male fat body mass (g)	80	0.001 - 0.247	0.063 \pm 0.062
male liver mass (g)	93	0.045 - 0.461	0.190 \pm 0.083
mass of epididymis (g)	82	0.002 - 0.041	0.013 \pm 0.009
mass of testicles (g)	93	0.004 - 0.132	0.052 \pm 0.30

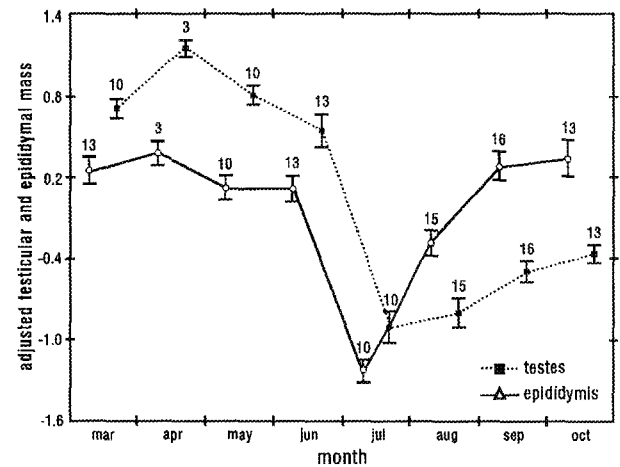


Fig. 5. Monthly changes (mean S.E. and sample size) in SVL adjusted testicular and epididymal mass of *P. muralis* throughout the activity period.

There was a significant correlation between SVL and testicular mass ($r=0.59$, $P<0.05$), and between SVL and epididymal mass ($r=0.37$, $P<0.05$), as well. The same significant correlations were found in other lizards (Vitt 1982; Castilla and Bauwens 1990; James 1991; Galan 1996). Also, there were significant differences among samples in SVL-adjusted testicular and epididymal mass (residuals of the regression of testicular and epididymal mass on male SVL; ANOVA, for testicles: $F=12.43$, $P<0.05$; for epididymides: $F=54.03$, $P<0.05$). Significant differences but in testicular volume and epididymal diameter among sampling periods were found in some other lizard species (Vitt 1982; Castilla and Bauwens 1990; Castilla *et al.* 1991; Pinilla 1991; Galan 1996).

The male reproductive cycle of *P. muralis* is similar to that of many other temperate zone lizards. The spermatogenetic cycle is of the "mixed type" in the terminology of Saint Girons (1963, 1982).

Viable spermatozoa were observed in March sample, which points out that mating season had already begun. Testicles and epididymis were enlarged during reproductive season, and spermatozoa were intensively produced. Testicular and epididymal weight declined during July, reaching a minimum in late July when reproductive season obviously ended. Correspondingly, production of viable spermatozoa terminated in July. We did not observe spermatozoa in late July sample. Increase in testicular and epididymal weight has already begun in August, and proceeded until the onset of hibernation.

CONCLUSIONS

Our study, as well as those done previously (Saint Girons and Duguy 1970; Kwiat and Gist 1987; Barbault and Mou 1988; Brana *et al.* 1991; Capula *et al.* 1993; Bejaković *et al.* 1995, 1996) confirmed the existence of considerable intraspecific variation in almost all female reproductive traits: size at maturity, onset of annual reproductive activity, clutch size, clutch frequency, RCM, egg proportions, correlations between reproductive variables, *etc.* These differences in female reproductive output are particularly distinct between Belgrade and Skadar Lake populations of *P. muralis*. It is noteworthy that these differences accompany morphological differences as lizards of Skadar Lake region are assigned to the subspecies *P. muralis albanica*. "Mixed type" of male reproductive cycle is similar to other temperate zone lizards, as well as correlations between some male reproductive variables (*e.g.* Castilla and Bauwens 1990; Castilla *et al.* 1991; Pinilla 1991; Galan 1996). Fat bodies cycle coupled with reproduction, shows similar pattern in both sexes, as well as in other lizard species from temperate zone (*e.g.* Castilla and Bauwens 1990; Castilla *et al.* 1991; Bejaković *et al.* 1995, 1996; Galan 1996).

Many factors (as argued by Gills and Balinger 1992), including phylogeny, adaptations to specific environmental conditions, and plasticity in characteristics that reflect immediate responses to proximate conditions, may well act in concert to produce the complex variation in female reproductive characteristics that have been documented in *P. muralis*.

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РЕПРОДУКТИВНИ ЦИКЛУС ЗИДНОГ ГУШТЕРА (*PODARCIS MURALIS*) НА ТЕРИТОРИЈИ БЕОГРАДА

И. АЛЕКСИЋ и КАТАРИНА ЉУБИСАВЉЕВИЋ

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У овом раду је праћен једногодишњи репродуктивни циклус зидног гуштера (*Podarcis muralis*) на територији града Београда. Минимална величина тела на којој женке постају полно зреле је била између 49.78 и 51.25 mm. Вителогенеза почиње крајем марта, док број и величина вителусних фоликула значајно варира током репродуктивне сезоне. Величина женки је позитивно корелисана са бројем, али не и са величином вителусних фоликула. Женке с овидукталним јајима су налажене од краја маја до краја јула. Током испитиване сезоне 1994. године постојала су два легла, са просечаном величином од 3.50 ± 0.31 јаја. Установљена је значајна позитивна корелација између величине женки и величине легла, док парцијална корелација између величине женки и просечне

запремине јаја, као и између величине легла и просечне запремине јаја није била значајна. Просечна релативна маса овидукталног легла је била 0.17 ± 0.01 и није била у корелацији са величином тела женки. Код анализираних мужјака тестиси и епидидимиси су имали највећу масу у периоду април-јуни, а најмању крајем јула. Пораст масе тестиса и епидидимиса је у директној вези са величином тела мужјака. Вијабилни сперматозоиди су налажени од марта до јула. Маса масних тела и јетре код мужјака је била најмања у време парења, док се маса масних тела код женки смањивала током вителогенезе. Значајна позитивна корелација између величине тела и масе масних тела и јетре је уочена код оба пола.