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AUTUMN PHOTOTHERMAL REGIMES AND REPRODUCTIVE FUNCTIONS IN THE FEMALE LIZARD *PODARCIS S. SICULA* RAF.

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In the lizard, *Podarcis s. sicula* Raf., as in other lizards living in temperate regions, after the breeding period (late July in northern hemisphere) a refractory period occurs, which renders the genital apparatus temporarily insensitive to stimulation by high environmental temperature (TINKLE & IRVIN, 1965; LICHT et al., 1969; CALLARD et al., 1972; FISCHER & EWALD, 1972; LICHT, 1973; ANGELINI & PICARIELLO, 1975; ANGELINI et al., 1976a, 1976b; CUELLAR & CUELLAR, 1977; BOTTE et al., 1978; BOTTE & ANGELINI, 1980a). During this phase the gonads are quiescent and the secondary sexual characteristics (SSC) appear poorly developed GÀLGANO & D'AMORE, 1954; BOTTE, 1973, 1974; ANGELINI & PICARIELLO, 1975). A refractory period is of considerable physiological value since, by inhibiting reproduction in the late summer, it prevents offspring hatching in the autumn when the temperature is declining and food is no longer aboundant (LICHT, 1973; BOTTE & ANGELINI, 1980a, 1980b). From September onwards, the refractory state progressively disappears and thus the still mild environmental temperature induces a partial resumption of activity in the gonads. This phenomenon is readily seen in the males where spermatogenesis but not SSC development is observed (ANGELINI & GÀLGANO, 1969; ANGELINI et al., 1980). In the females, only a limited ovarian stimulation can be detected; it consists in a small growth of several oocytes which, however, do not start vitellogenesis. The oviducts, on the contrary, remain in a resting phase (BOTTE, 1973). In addition, previous experimental work has shown that the renewed sensitivity of the gonads to environmental stimuli in the autumn could be important, in both sexes, for the incorporation of some ambient signals which act as regulatory mechanisms for the next reproductive cycle. In the male, *Podarcis s. sicula*, maintenance for some weeks in autumn with photoperiod longer than the ambient and with a high temperature induces precocious testicular recrudescence and long-lasting spermatogenetic activity the next spring; the opposite effects follow exposure to short photoperiods or darkness (ANGELINI et al., 1980). In the female of the same species, rearing from October, high thermal regimes prevent recrudescence of the ovary the next spring (BOTTE et al., 1978). This confirms the importance of exposure to cool temperature in the autumn to overcome refractory period, as shown by LICHT (1973) for the iguanid, *Anolis carolinensis* Dum. & Bibr.

These observations led us to investigate in more depth the relationships between autumn photothermal regimes and subsequent spring recrudescence of the gonad in order to see if, as in the male, there are systems which induce delayed effects on reproductive activity in the female *Podarcis s, sicula*.

MATERIAL AND METHODS

Animals and their maintenance. Adult, male and female, *Podarcis s. sicula* Raf. (Reptilia Lacertidae), captured in the neighbourhood of Naples, in the second half of September, were used. We chose lizards living in a relatively restricted narrow area (Acerra) to minimize population heterogeneity. Only adult females of 7-9 g weight and 6-7 cm snout-vent length were selected because sexual maturity is reached in females when the snout-vent length is about 5.7 cm (FILOSA, 1973). Thirteen groups, each formed of 25 males and 25 females, were reared in terraria, and fed on meal worm and fresh vegetables *ad libitum*. During the experimental treatments the lizards were maintained in cabinets where it was possible to regulate both temperature and photoperiod. After the experimental treatments the animals were returned to terraria, located in the open air, where they were exposed to environmental photothermal regimes until the end of the next summer. Except for some cases reported below, the mortality rate was low (less than 10% after 10 months).

Experimental treatments. The schedule of photothermal treatments is shown in Table 1. They began on September 21 and lasted 21 or 41 days, afterwards the animals were placed with the untreated lizards in outside terraria.

Macro- and microscopic observations. During the winter, since the animals hibernate, the terraria were inspected only on mild sunny days when many lizards, at noon, left the shelters to get food. After the emergence (March) the terraria were inspected each day and the lizards were carefully observed for a while to note differences in their appetite, locomotory activity, male-male aggressiveness and courtship. During the breeding season the presence of eggs was checked; those which appeared healthy were incubated to ascertain if they were fertile, the others where only inspected to assess the presence of various components (shell, albumen and yolk).

A total of five males and the same number of females were taken at ramdom from the various experimental groups at the end of May, June and July. At dissection, the degree of development of the gonads and genital ducts was assessed. The animal body, gonads and genital tracts (oviducts in the females) were weighed. The tissues were then fixed in Stieve's fluid and used for serial histological sections. The results

Table 1.

Treatment of adult female Podarcis s. sicula *Raf. with various photothermal regimes in the autumn (starting from September 21) and body weights recorded in the next breeding period.*

Groups	No. lizards ♀	Length of treatment	Temperature (in °C)	Photoperiod	Body weights in the breeding period (in grams) (1)
C	25	—	ambient (2)	ambient (2)	8.17 ± 0.36
ETD	25	21 and 41 days	ambient (2)	dark (3)	8.00 ± 0.30
HTD	25	21 and 41 days	30 °C	dark (3)	7.74 ± 0.30
ETS	25	21 and 41 days	ambient	8:16 L:D (4)	7.50 ± 0.63
HTS	25	21 and 41 days	30 °C	8:16 L:D (4)	7.70 ± 0.80
ETL	25	21 and 41 days	ambient	16:8 L:D (5)	7.08 ± 0.80
HTL	25	21 and 41 days	30 °C	16:8 L:D (5)	7.64 ± 0.83

Groups: C, captive untreated lizards; ETD, environmental temperature-dark; HTD, high temperature dark; ETS, environmental temperature-short photoperiod; HTS, high temperature-short photoperiod; ETL, environmental temperature-long photoperiod; HTL, high temperature-long photoperiod.

(1) The lizards were weighed at the end of treatments of 21/41 days and again when they were sacrificed in May, June and July. The average weight in November, at the end of 21/41 days treatment, did not differ from that of the lizards of group C. In each experimental group, since statistically significant weight modifications were not observed throughout the breeding season, the data have been combined.

(2) Temperature and photoperiod decreased in nature respectively from 20 °C in late September to 11 °C in early November (average values), and from 13 to 11 hr daylight (civil photoperiod in Naples).

(3) These terraria were illuminated, during the 21/41 days of the experimental period, for 15 min near noon for cleaning and feeding. A filter (Kodak Wratten no. 48A) was applied to the fluorescent lamp to minimize the light effect (LICHT, 1969). Moreover, it must be recalled that short period of illumination during the day are of poor value in stimulating the gonads (see LICHT, 1972).

(4) The lighting was regulated from 8 a.m. to 4 p.m.

(5) The lighting was regulated from 4 a.m. to 8 p.m.

concerning the males have been reported elsewere (ANGELINI et al., 1980). In this paper the observations carried out on the females will be presented. In the ovary the developmental stage of yolky ovocytes and the presence of postovulatory and atretic follicles were assessed using the method of FILOSA (1973). The relative development of different regions of the oviduct (infundibulum, tuba, uterus and vagina) was evaluate according to methods previously reported (BOTTE, 1973). All the morphological data have been compared to those obtained for free living animals from the same region as that of our experimental animals (cf. FILOSA, 1973; BOTTE et al., 1976).

RESULTS

Table 1 shows, besides the experimental schedule, the average weights of lizards throughout the breeding season. It is clear that the different photothermal regimes used in the autumn and the length of treatment (21 or 41 days) do not induce great weight differences the next spring. Animal observation, during cleaning and feeding, did not revealed any differential aspect of appetite and locomotory activity. After emergence from hibernation, in March, for some weeks the males were often engaged in male-male fights. In April this behaviour progressively gave way to male-female courtship.

Table 2 summarizes egg production in the different groups. The depositions occurred at three times during the reproductive period: at the end of May, from the 12th to 20th of June and the last 5 days of July. The lizards, which were maintained during autumn for 21 or 41 days in darkness (ETD, HTD), for short photoperiods (HTS 8:16, L:D) or long photoperiods (ETL, HTL 16:8, L:D), all laid more eggs than those living during the same season with the natural photoperiod (C 13-11 hr of daylight). Neither temperature (ambient: from 20 °C in September to 11 °C in November; high: 30 °C) nor treatment length (21 or 41 days) influenced the egg production rate. In the groups treated with long photoperiods, however, those lizards that also experienced high temperature for 41 days in the autumn show a better egg yield. It should be noted that in the groups treated with a short photoperiod the egg production is intermediate between that observed in the animals kept in darkness or long photoperiods, on one hand, and those in natural photoperiods, on the other. It must be noted, however, that the lizards treated for 21 days with short photoperiods inexplicably died before the beginning of the reproductive season.

The eggs laid by lizards living during autumn with natural or long photoperiods were always fertile. Those of animals that experienced short photoperiods or darkness were normal and fertile in May, but, from the June deposition, many of them produced eggs devoid of albumen.

Table 3 shows the relationship between autumn photoperiod and the weights of the ovary and oviduct during the following reproductive season. The data from different groups have been combined according to photoperiod since both treatment length and temperature did not produce significant effects. It appears clearly that the lizards kept during the autumn in darkness or with short or long photoperiods achieve maturity the next spring in advance of those living during autumn with the natural photoperiods who develop mature gonads and oviducts only in June. In experimental groups the weights of the ovaries decrease, in some cases, during June and July, but this trend does not reflect modification of reproductive

Table 2.

Ovulation rates in the lizard, Podarcis s. sicula, *manitained during the autumn with different photothermal regimes.*

Groups (1)	Treatments in autumn (starting, September 21)			Depositions during the breeding period (May-July)								
				May (3)			June (3)			July (3)		
	days	photoperiod (2)	temperature (2)	(4) A	B	C	A	B	C	A	B	C
ETD	21	0:24 L:D	ambient	20	36	1.80	15	32	2.13	10	0	0
ETD	41	0:24 L:D	ambient	24	36	1.50	19	63	3.31	12	3	0.25
HTD	21	0:24 L:D	30 °C	20	22	1.10	15	28	1.86	10	6	0.60
HTD	41	0:24 L:D	30 °C	23	23	1.00	18	33	1.83	13	19	1.46
						1.35 ± 0.18			2.28 ± 0.34			0.57 ± 0.3
HTS	21	8:16 L:D	30 °C	16	6	0.37	11	16	1.45	6	13	2.16
HTS	41	8:16 L:D	30 °C	20	5	0.40	15	15	1.00	10	12	1.20
						0.38			1.22			1.78
C		ambient	ambient	21	0		16	15	0.93	11	0	0
ETL	21	16:8 L:D	ambient	22	18	0.81	17	48	2.82	12	6	0.50
ETL	41	16:8 L:D	ambient	20	15	0.75	15	43	2.86	10	18	1.80
HTL	21	16:8 L:D	30 °C	24	16	0.66	19	28	1.47	14	24	1.71
HTL	41	16:8 L:D	30 °C	25	20	0.80	20	68	3.40	15	15	1.00
						0.75 ± 0.03			2.63 ± 0.41			1.25 ± 0.30

(1) Groups: see Table 1.
(2) For better definition of the photoperiods and the temperature see: Table 1.
(3) During the breeding period the depositions largely occurred during the last 5 days of May, from 12th to 20th of June and during the last 5 days of July.
(4) A, number of females present in the group; B, number of eggs collected from the terraria; C, ratio eggs/females. The average total egg production in relation to the photoperiod was: « darkness » = 75 ± 9.7; 8:16 L:D = 33; ambient = 15; 16:8 L:D = 77 ± 8.67.

activity since, as shown in Table 2 many eggs are laid in these months. Clearly the random samples of June and July included mainly lizards in the post-ovulation stage with small growing vitellogenetic oocytes in the ovary.

Table 3.

Autumn photoperiod and development of the ovary and oviduct during the next reproductive period in the lizard Podarcis s. sicula. *Since the differences in treatment length (21 or 41 days, starting from September 21) and temperature (ambient or 30 °C) had no effect, the data from each subgroup have been combined. Hence, the figures refer to average value ± SE of all the lizard of each subgroup examined in the various months.*

Photoperiod (1)	Breeding season		
	May	June	July
0:24 L:D	26.69±8.6*	11.59± 4.26	1.59±0.10
	7.26±1.85*	6.72± 0.78	2.08±0.40
8:16 L:D	11.60±4.24	2.68± 0.58	2.55±0.74
	9.92±5.63	2.66± 0.54	1.92±0.39
11−11:11−13 L:D	3.52±0.05	26.57±12.89	1.36±0.14
(ambient)	3.74±0.37	8.54± 3.20	1.99±0.13
16:8 L:D	23.14±8.37	3.80± 0.40	9.19±7.30
	8.30±1.77	3.99± 0.50	3.19±1.07

(1) See: Material and Methods for a better definition of the photoperiod used in the autumn.
* First line = ovary somatic indices $\times 10^{-3}$; second line = oviduct-somatic indices $\times 10^{-3}$.

Morphological observations. In captive untreated animals (C; 13-11 hr of light and ambient temperature) ovaries and oviducts are at the beginning of their development in the samples of late May, they are fully mature in June and in regression at the end of July. In the ovary during May several follicles are vitellogenetic and in June some of them are near to full maturity. In this month the ovaries can contain some post-ovulation follicles but no atretic follicles. The oviducts in May show the beginning of development of their uterine and vaginal regions; in June the whole oviduct is mature and the glands in both tubal and uterine regions are hypertrophic (Figs 1, 2). In July regression occurs; it starts in the tubal region whereas the uterus and vagina remain developed for a longer time.

In the lizards kept in darkness during the autumn (in all groups: ETD-HTD, treated for 21 or 41 days, with ambient or high temperature), the recrudescence of the ovary is already apparent in May when many oocytes are vitellogenetic and several of them are near to full maturity. Post-ovulation follicles are also present. A similar appearance is observed in June and July, even though the vitellogenetic, mature follicles are remarkably fewer in number. In June, and more so in July, some atretic follicles are found.

Histological sections of the oviduct show that this organ reaches maximum development in late May, whereas in July it is involuted. This phenomenon mainly involves the tubes and could explain the presence, in this groups, of eggs (laid in July) devoid of albumen.

In the lizards maintained during the autumn with short photoperiod (HTS), the results are very similar to those described for the previous group. In each sample, vitellogenetic follicles are present in the ovaries, but their number is lower. Moreover, in June and July, many atretic follicles can be found.

The oviducts are fully mature at the end of May. In June the tubal region is regressed and contains only a few glands. This again could explain the deposition of eggs (laid in June and July) devoid of albumen (Figs 5, 6).

In the lizards maintained in autumn with long photoperiod (ETL-HTL), ovary and oviduct keep itself long active during the breeding period (Figs 3, 4), even if the first signs of regression become apparent at the end of July. In the gonads, throughout the breeding period several oocytes are vitellogenetic and also post-ovulation follicles are present. Atretic follicles are very rare.

The oviducts are already mature in May and show a tubal region which is very hypertrophic; only in late July are some early signs of regression (gland reduction) observed in this organ.

DISCUSSION

A brief summary of the main stages of the sexual cycle of the female lizard (*Podarcis s. sicula*), both free and in captivity, is useful for the discussion on the results reported in this paper. After emergence from hibernation (late March) the ovary and genital tracts slowly resume their growth until the end of April when this process becomes rapid (FILOSA, 1973) and in the middle of May brings to maturity two or three eggs per ovary. Ovulation and deposition take place in the second half of May; some delay can be observed in a very cold spring. It is probable that several females can ovulate again in the middle of June and July, depending on the living site and food availability. A normal female of this species, therefore, could lay about 15 eggs during the breeding season.

A long period of captivity does not alter the general pattern of the sexual cycle, but only one deposition is observed which is delayed until June (BOTTE et al., 1976). The egg yield, moreover, is quite low and some females produce only one oocyte. Rarely, some females do not ovulate (ANGELINI, unpublished observations).

The oviducts follow the ovary in their seasonal development. They grow in May and remain active until the end of July (BOTTE, 1973). In captivity they become mature only in June.

Our experiments show that in both the male (ANGELINI et al., 1980) and the female of *Podarcis s. sicula*, the activity of the gonad during the breeding period can be affected by the autumn photothermal regime. Maintenance of adult females with photoperiods longer (16:8, L:D) or shorter (8:16, L:D or total darkness) than the environmental ones (13-11 hr of daylight in early autumn), starting from September 21st and lasting 21 or 41 days, results in the laying of an increased number of eggs during the next spring. Moreover, while the lizards maintained with long or short photoperiods or in darkness had three deposition (May, June and July) a single one (June) was observed in those kept with an ambient photothermal regime in the autumn.

The early autumn photoperiod, therefore, seems to restrict the activity of the ovary. An analysis of the natural photoperiods during the spring recrudescence of the female gonad indicates that the latter starts only when 13 hr daylight is exceeded and, very interestingly, this is the photoperiod of the beginning of September. Therefore, in this month, when the post-reproductive refractory period is disappearing, the environmental photo-

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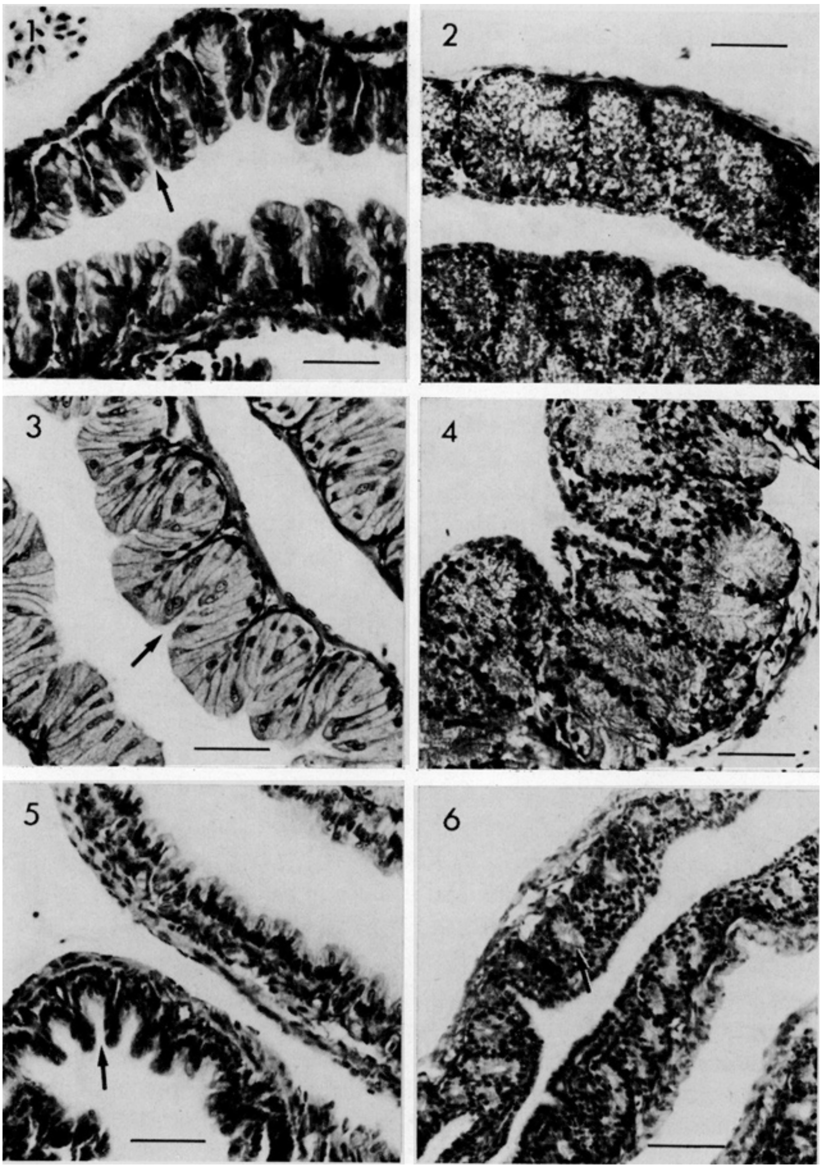
Figs 1-6. — Histological sections of the oviduct of the lizard *Podarcis s. sicula* Raf. which were kept during the autumn (starting from September 21) at different photothermal regimes for 21 or 41 days. They were then transferred to outside terraria until the end of June when they were sacrificed.

Figs 1 and 2 are sections respectively of tubal and uterine regions of a captive untreated animal (kept during autumn under the ambient photothermal conditions). Note that both regions of the oviduct are well developed. Epithelial and glandular cells contain many secretory granules; the special glandular crypts (arrow) in the tuba, are clearly seen.

Figs 3 and 4 are sections of the same tissues as in Figs 1 and 2, obtained from a lizard that, during the autumn experienced a long photoperiod (16 hr) associated with a high temperature (30 °C). Note the enormous development of the tubic crypts (arrow) and the hypertrophy of the uterine glands.

Figs 5 and 6 are sections of the same tissues as in Figs 1 and 2 obtained from a lizard kept during the autumn in short photoperiod associated with high temperature. Both regions are regressed compared with controls, with the tubic crypts (Fig. 5, arrow) and the uterine glands (Fig. 6, arrow) barely recognizable.

Scale lines = 50 μ.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period could be recorded by lizards and utilized the next spring to keep the ovary undeveloped until the end of March. Only in late March do some ovarian follicles, of about 2,000 μ diameter, start their growth. When a 16 hr photoperiod is reached, at the end of April, this process proceeds very rapidly (FILOSA, 1973). In the male, on the contrary, testicular recrudescence starts at the end of February and the autumn environmental photoperiod does not inhibite its growth (ANGELINI et al., 1980).

This phase-displacement of the beginning of gonad development in the two sexes during the spring could be of physiological relevance for reproductive behaviour. Starting from the end of February the lizards, mainly the males, tend to leave their hibernacula; the males are soon engaged in fights for dominance which are linked to the endocrine activity of the gonads. Only a few observation have been carried out in *Podarcis s. sicula* but this male-male aggressive behaviour has been exaustively studied in the iguanid, *Anolis carolinensis*, whose males are engaged in fights for some weeks after emergence in order to establish reproductive territories and, hence, do not court the females (CREWS, 1975, 1977, 1979). Therefore, a mechanism to delay maturation of the ovary is useful and in this species it is achieved easily since development of the ovary is inhibited by male aggression and facilitate by male courtship which starts only when the fights have ended (CREWS, 1974, 1979; CREWS et al., 1974). In *Podarcis s. sicula* a similar phase-displacement could, in addition, depend on the inhibitory influence of an autumn photoperiod recorded by animals in this season. On the other hand, it cannot be excluded that a similar mechanism operates in *Anolis carolinensis*; in this species, in fact, long days may be need with a moderate amount of heat to stimulate growth of the ovary in nature (LICHT, 1973). A delayed emergence of the females occurs in different *Lacerta* species of North Europe: it has been recorded in *Lacerta vivipara* Jacq. living in England and in *Lacerta agilis* L. of the Netherlands (AVERY & MCARDLE, 1973; NULAND & STRIJBOSCH, 1981), but at present, no certain data are available for *Podarcis s. sicula.*

Phase-displacement in the resumption of activity in the gonads of the two sexes is very useful in that it prevents out-of-season ovulation in early spring when particularly mild weather could precipitate reproductive activity when the ground is still to cool to allow embryonic development.

In our experiment photoperiods both longer and shorter than those of autumn (13 to 11 hr) stimulate ovarian activity. The short photoperiod occur in winter when the lizards hibernate and therefore is without effect. In fact, if females leave the shelters on very mild days they never reach the « permissive » temperature which initiates development of the gonad. In this situation only general metabolic activities are possible (LICHT et al., 1969; LICHT, 1973; ANGELINI et al., 1976a). According to several observations, the « permissive » temperature in *Podarcis s. sicula*, lower for spermatogenesis than for oogenesis and the endocrine activities of the gonads, is reached only in the spring in temperate regions (LICHT, 1967, 1973; LICHT et al., 1969; ANGELINI et al., 1976a).

The response of the gonad to modifications of autumn photothermal regimes shows some important differences in the two sexes. In the males, temporary alterations of photoperiod are effective only if combined with high temperature (ANGELINI et al., 1980). In females high temperature is not required; the environmental temperature is enough. In any case, the lizards have some thermoregulatory capabilities (FISCHER, 1969) and can maintain a body temperature near to the optimal by direct or indirect exposure to the sunbeams even on quite cool days (AVERY, 1976). If this compensatory mechanism works in the female, we must explain why it does not work in males.

In autumn, at the end of the refractory period, the male gonad responds to phothermal stimuli as it does in the spring. The association of long photoperiods and high temperature for some weeks in the autumn, facilitates recrudescence of the gonad in the spring; reverse effects are obtained with short photoperiods or darkness (ANGELINI et al., 1976a, 1980). As has been reported before, the effect of different photoperiod regimes are different in the female.

Our investigations have also brought to light other points which are worth discussing. In the course of a reproductive season each female can lay more than one egg cluth and, at least in captivity, the deposition occur in the same period, despite the experimental treatments given in the autumn. The control mechanism of this phenomenon is not known and no data are available to indicate that this kind of synchronization is operating in free living lizards.

The stimulating effects of darkness or short photoperiods on egg production has been reported for other lizards (STEBBINS & COHEN, 1973; LEVEY, 1973). Darkness positively influences the production of spermatozoa and the development of the epididymis in the male, *Podarcis s. sicula* (ANGELINI et al., 1976a, 1980). The hypothesis that these effects depend on epiphysis inhibition has not found experimental support (LICHT & PEARSON, 1970; STEBBINS & COHEN, 1973). In addition, in female *Podarcis s. sicula* shielding of the parietal bones is followed by higher egg production (ANGELINI, in preparation).

The high egg yield observed in females treated in the autumn with long photoperiods could indicate that this photoperiod is near to the optimum for physiological stimulation of the ovary. In fact, the main deposition in nature, in the second half of May, occurs when the photoperiod is around 16:8, L:D. Similarly, this photoperiod is very favourable for egg production in battery hens (MORRIS, 1973, 1979).

In lizards on short photoperiods or complete darkness, the oviduct behaves oddly. Whereas in captive untreated animals or in those treated with long photoperiods it develops and regresses in concomitance with the ovary, in lizards kept during the autumn with short photoperiods or in the dark, it grows together with the ovary but regresses earlier. This phenomenon affects first the tuba and therefore eggs devoid of albumen are laid. The mechanism of this regulation is, at present, not known. Oviducts are under endocrine control from the ovary (BOTTE, 1973, 1974), but a sudden decrease in steroid hormone output should be excluded since vitellogenesis, also dependent on these hormones (see CALLARD & LANCE, 1977; CALLARD et al., 1978), is still active. A refractory period with respect to circulating hormones could be hypothized; this should follow a depletion of the sex-hormone receptors as observed in nature at the end of the breeding period (BOTTE et al., 1974; BOTTE & GRANATA, 1977). A variable sensitivity of target organs to circulating sex hormones has been demonstrated by PEARSON et al. (1976) in male, *Anolis carolinensis*. The early regression of the oviduct in females treated during the autumn with short photoperiods or with complete darkness, could be ascribed also to the presence in the experimental groups of less active males; this treatment, in fact, cause a precocious regression of the testis and SSC. According to CREWS et al. (1974, 1979), in *Anolis carolinensis* intact males are essential to the female if she is to lay shelled eggs because active males stimulate an adequate level of gonadotropin secretion.

In conclusion, our data show that the control mechanisms of the reproductive processes in lizards inhabitating temperate regions are very complex. There are several problems which remain unsolved, and it is these which make the study of reproductive biology in these vertebrates particularly interesting.

SUMMARY

Modification of autumnal photoperiods (starting from September 21) for 21 or 41 days, interferes with the activity of the ovary during the following spring.

Short treatments with photoperiods of 8, 16 hr or constant darkness, induces in the female lizard *Podarcis s. sicula* Raf. (Reptilia Lacertidae) an increased egg-production and a longer period of ovarian activity than observed in animals exposed to the ambient photoperiod (13-11 hr).

These results indicate that the autumnal photoperiod inhibits the ovary which resumes its development only when, at the beginning of April, the photoperiod exceeds 13 hr daylight.

The autumnal photoperiod also seems to regulate the development of the oviduct (probably through ovarian endocrine activity). This organ, in fact, functions for the period of ovarian activity in controls and in lizards treated with long photoperiods, but it atrophies precociously in animals kept during autumn under short photoperiods or in constant darkness.

RIASSUNTO

Nella femmina della lucertola *Podarcis s. sicula* Raf. (Reptilia Lacertidae), l'allevamento per tempi limitati (21 o 41 giorni) a partire dai primi dell'autunno, con regimi fototermici diversi da quelli naturali, si riflette in maniera significativa sul successivo ciclo sessuale, modificando la durata dell'attività ovarica, la quantità di uova deposte e la funzionalità delle varie parti dell'ovidutto. Il fotoperiodo naturale della prima parte dell'autunno (tra 11 e 13 ore) è, a tal fine, il meno favorevole, mentre fotoperiodi più lunghi (16 ore) o più brevi (8 ore o buio) inducono una maggiore produttività ovarica. L'ovidutto risulta invece stimolato più a lungo solo dai lunghi fotoperiodi.

Il fotoperiodo naturale della prima parte dell'autunno (11-13 ore) esplica quindi una funzione inibitoria sulla ripresa ovarica, la quale ha luogo nella successiva primavera solo quando tale fotoperiodo viene superato. Questo consente di sfasare di un certo tempo i cicli sessuali maschili e femminili e dà tempo ai maschi di completare le lotte per la territorialità, prima di procedere al corteggiamento e agli accoppiamenti.

Il complesso dei dati convalida che i regimi fototermici dell'autunno hanno, anche per le femmine, un ruolo di primo piano nella regolazione del ciclo sessuale di *Podarcis s. sicula*.

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