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Reproductive Cycles in Two Arkansas Skinks in the Genus *Eumeces* (Sauria: Scincidae)

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Abstract

Reproductive cycles of the southern coal skink (*Eumeces anthracinus pluvialis*) and the five-lined skink (*E. fasciatus*) were studied by examining museum specimens collected in Arkansas. Histological preparations of testes from each species revealed eight spermatogenic stages. Male coal skinks produced sperm by late February, at least one month before male five-lined skinks. Height of the testicular cycle (maximum sperm production–stage 6 = spermiogenesis) in *E. a. pluvialis* occurred in March and early April, whereas in *E. fasciatus*, spermiogenesis reached a peak in May. Testicular recrudescence began in late May in *E. a. pluvialis* and mid-July in *E. fasciatus*. The reproductive condition of female skinks was determined by counting and measuring enlarged ovarian follicles and oviductal eggs. Female coal skinks contained vitellogenic ovarian follicles starting in mid-March; vitellogenic ova reached their maximum size by mid-April. Oviductal eggs were recorded from early April to mid-May. Clutch size in *E. a. pluvialis* averaged 10.5 (5 - 17; n = 27) based on vitellogenic ova and 9.6 (8 - 13; n = 21) based on oviductal eggs. No egg clutches of *E. a. pluvialis* were discovered. In female *E. fasciatus*, a rapid increase in the rate of vitellogenesis began in late April; yolking ova were last observed in an individual in mid-June. Oviductal eggs were recorded from mid-May to late June; average clutch size based on vitellogenic ova was 10.0 (7 - 15; n = 34), whereas oviductal eggs yielded an average clutch size of 8.4 (6 - 12; n = 13). Atresia of ovarian follicles may explain the difference between counts. Clutch size as determined from five nests discovered in June and July was 8.2 (7 - 10). Intraspecific synchrony of annual sexual cycles occurs between the sexes of each skink, while only a marginal overlap exists between the two species.

Introduction

Northern Hemisphere *Eumeces* (Scincidae) are represented in the southcentral United States (Zug, 1993) by four oviparous species (*E. anthracinus, E. fasciatus, E. inexpectatus,* and *E. laticeps*). Compared to the other three species, surprisingly little is known about the reproductive ecology of the coal skink, *E. anthracinus*, a member of the *anthracinus* group of eastern four-lined skinks (Smith, 1946). Moreover, reproduction in this species has received no detailed study; published information on clutch size in brooding females has appeared anecdotally (Sexton, 1984) or as brief accounts in state herpetology books (e.g., Mount, 1975; Johnson, 1987; Dundee and Rossman, 1989; Collins, 1993). Fitch (1970, 1985) had no data on coal skinks in his general summaries on lizard reproduction. In contrast, the life history and reproductive biology of the five-lined skink (*Eumeces fasciatus*), a member of the *fasciatus* group of five-lined skinks (Smith, 1946) and a species common throughout much of the eastern and central United States (Conant and Collins, 1991), have been well documented (Fitch, 1954, 1970, 1985; Vitt and Cooper, 1986; Shadrix et al., 1994).

The coal skink has a relatively broad but patchy range east of the Mississippi River, whereas it has a nearly continuous distribution throughout the Interior Highlands of Arkansas, Missouri, Kansas, and Oklahoma; its range also extends into portions of northern Louisiana and eastern Texas (Conant and Collins, 1991). The southern coal skink, *E. a. pluvialis*, is known to occur in at least 34 of the 75 counties in Arkansas (Trauth, unpubl.). Collection of this species in Arkansas is mostly sporadic at best. Individuals are often observed in forest habitats near streams although they can also be taken in moist areas along cedar glades (see Sexton, 1984). Sampling is mostly confined to late winter and spring months. On the other hand, *Eumeces fasciatus* is encountered in a variety of habitats in Arkansas, especially in pine and oak-hickory forests from March through October. These two species have similar morphologies and are sympatric in Arkansas; yet they prefer slightly different habitats. In the present study the reproductive ecology of *E. anthracinus* was compared to that of sympatric *E. fasciatus* to determine whether any observed differences might represent higher taxonomic level (species group) differences.

Materials and Methods

Reproductive data were amassed from 64 adult *E. a. pluvialis* (21 males; 43 females) and 219 adult *E. fasciatus* (112 males; 107 females) during this study. Most coal skinks (n = 30) and five-lined skinks (n = 167) were collected over a 10-year span (1984-1993). Sampling occurred primarily within the Ozark Mountains of northeastern Arkansas; museum voucher specimens from Arkansas were also examined. Skinks were obtained by hand and were processed in the lab at Arkansas State University within 48 hr after capture. Lizards were killed with an intraperitoneal injection of a dilute solution of sodium pentobarbitol and fixed in 10% formalin. Following fixation, the snout-vent length (SVL) was measured to the nearest mm. Specimens were later transferred to 70% ethanol for permanent storage.

Routine histological techniques were used to prepare testes and attached epididymides for light microscopy. Tissues were dehydrated in a graded series of ethanol, cleared in xylene, embedded in paraffin, sectioned into 10 μm serial strips (affixed to glass slides using Haupt's adhesive), and stained using Harris hematoxylin followed by counterstaining with eosin (H & E). The testicular cycle was staged according to spermatogenic condition (Mayhew and Wright, 1970). Testicular stage refers to spermatocytogenic development starting with spermatogonia and ending with the release of sperm into lumina of the seminiferous tubules; these eight stages, briefly summarized, are as follows: 1) division of germinal cells, 2) primary spermatocytes predominate within tubules, 3) secondary spermatocytes reside at luminal borders, 4) undifferentiated spermatids at luminal borders, 5) metamorphosing spermatids at luminal borders, 6) mature sperm at luminal borders and within expanded lumina, 7) early epithelial regression with some sperm at luminal borders and within lumina, and 8) complete epithelial regression with no sperm within lumina. A morphometric analysis of both the seminiferous and epididymal tubules was performed to evaluate variation in size of these structures. The procedure involved tracing of tubule perimeters onto a digitizing tablet (The Morphometer[R], Woods Hole Educational Associates, Woods Hole, MA) using a cursor and a compound light microscope (at 150X mounted with a camera lucida). The system was interfaced with a Zenith Data System ZVM-1380-C computer; summary statistics for perimeter data were compiled as a feature of the software. In most cases, 25 true to nearly true cross sections of tubules were selected for quantification. Because epididymal tubules vary regionally, tubules were chosen primarily within the most columnar region of the epididymis. In addition, tubule epithelial height was measured with a compound light microscope (at 400X) with the aid of an ocular micrometer.

In females the diameter (to the nearest 0.1 mm) and number of vitellogenic ova were recorded along with the number of oviductal eggs. Measurements were taken with vernier calipers or with an ocular micrometer and dissecting microscope.

Voucher specimens and prepared histological slides are deposited in the Arkansas State Univeristy Herpetology Museum. Additional museum specimens examined during the study were from the Milwaukee Public Museum, University of Kansas Museum of Natural History, and the Carnegie Museum. Specimens examined from these museums that were catalogued without a day of collection were not included on any figure warranting an exact date. All descriptive statistics are given as means $\pm$ two standard error (2SE). Parametric (least square regression) and nonparametric tests (Mann-Whitney rank sum test) were employed; an alpha level of 0.05 was set.

Results

***Testicular Cycle in* Eumeces anthracinus pluvialis *and Comparisons with* Eumeces fasciatus.**--Evaluation of the testicular histology of *E. a. pluvialis* revealed seven of the eight spermatogenic stages (stage 4 not observed). At the onset of seasonal activity in early February, seminiferous tubules were in stage 3 (Fig. 1B); the secondary spermatocytes appeared scattered along the luminal margins and were only one or two cell layers in thickness. Average seminiferous tubule perimeters were nearly twice the size as seen in stage 2 tubles (found in only one specimen in October); this dramatic increase in volume was a consequence of a gain in luminal size rather than an increase in tubule epithelial height which had remained relatively unchanged (Table 1). Spermiogenesis (stages 5 and 6) occurred from late February to late April at the same time seminiferous tubles had reached their maximum perimeter size. During stage 5, large numbers of nutritive Sertoli cells were evident throughout the germinal epithelium (Fig. 1C). Stage 6 commenced as aggregates of transforming spermatids formed pyramid-like clusters about the Sertoli cells (Fig. 1D), whereas loosely-packed sperm formed masses inside lumina. At these two stages, the epididymal tubule epithelial height had doubled in thickness over stage 3 (Fig. 2C, D; Table 1) in preparation for receiving sperm. Spermatocytogenesis did not appear to continue beyond stage 6; this resulted in a decrease by over 50% in the height of the germinal epithelium from stage 6 to stage 7. Accordingly, there was a marked decrease (37%) in the average size of seminiferous tubules (Fig. 2A). Epididymal tubules had also reached their maximum size during stage 6. Most testes were in either stage 7 or 8 by mid-April, although some sperm were still being released from the germinal epithelium

during stage 7. The spent testis (stage 8) was characteristically devoid of all sperm within the seminiferous as well as the epididymal tubules (Fig. 2B, F). Cellular debris could be found within lumina in either case. The germinal epithelium exhibited one or two layers of cells, commonly known as the germinal-Sertoli cell syncytium, and had a height equal to less than 20% of its maximal thickness at stage 5. Interstitial cells with highly eosinophilic cytoplasms resided conspicuously between adjacent seminiferous tubules. The epididymal tubules, as stated above, undergo a cyclicity in volume and epithelial height similar to that experienced by the seminiferous tubules (Table 1; Fig. 2C-F). When sperm were present, the epithelium changed from irregular low columnar cells in stage 3 (Fig. 2C) to tall cells with basal nuclei (Fig. 2D). As these secre-

tory columnar cells lost their integrity by providing nourishment (exocytosis?) or support (possibly in conjunction with extracellular tubules; see Newton and Trauth, 1992) prior to ejaculation, the epithelium became hetermorphic, less uniform, and was depleted of cytoplasmic materials (Fig. 2E). Consequently, sperm masses within the tubules often appeared eosinophilic as a result of these added cellular constituents following staining with H & E. At stage 8, the columnar epithelial cells appeared pseudostratified with greatly reduced cytoplasms.

Testicular histology of *E. fasciatus* (Fig. 3) conformed closely to that previously described for *E. a. pluvialis*. All eight spermatogenic stages were observed (Table 1; Fig. 3). Table 1 shows a morphometric comparison of the seminiferous and epididymal tubules of the two species.
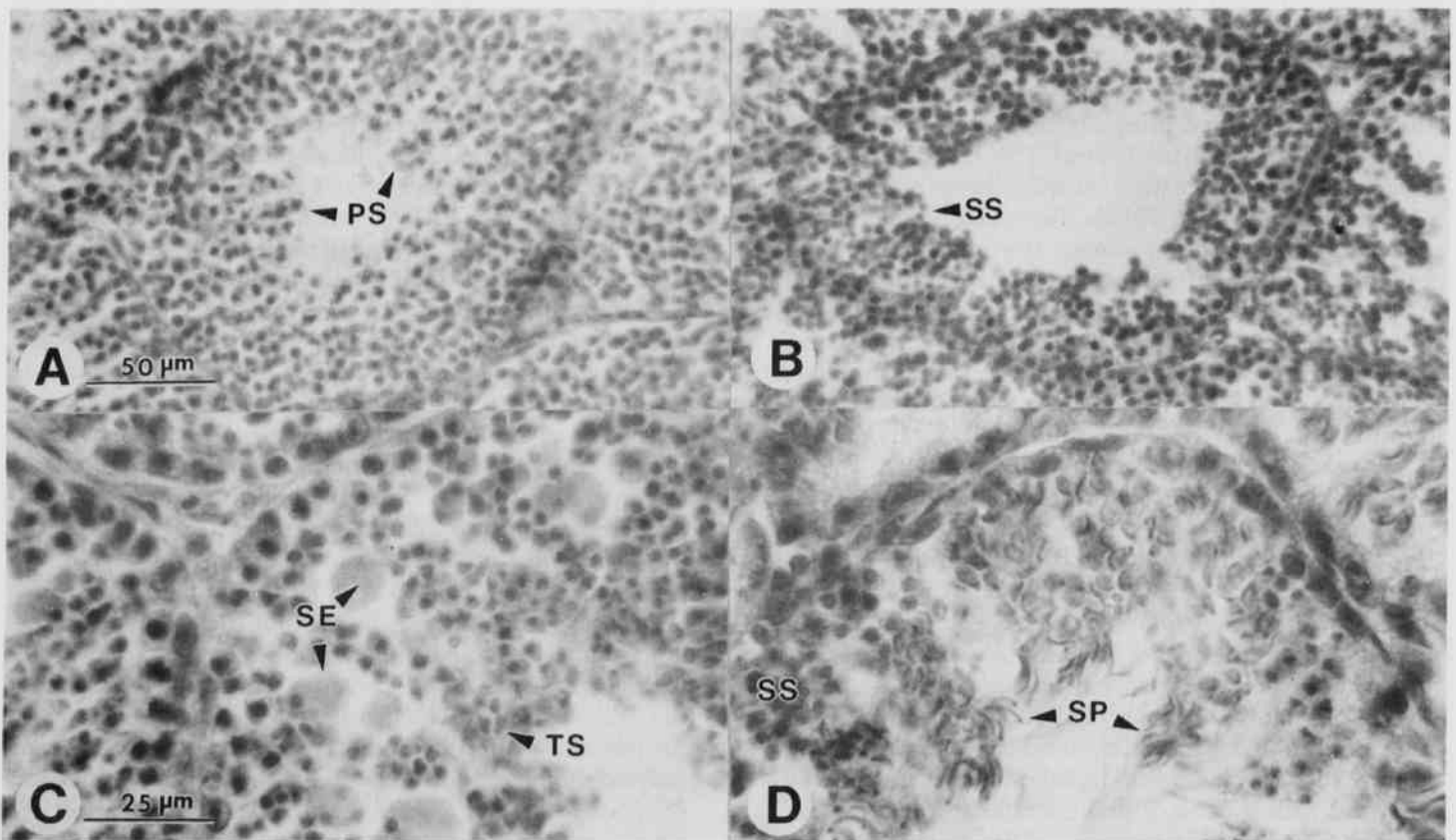

Fig. 1. Photomicrographs of seminiferous tubules of *Eumeces anthracinus pluvialis* collected in Arkansas. A. Section through a tubule illustrating stage 2 from specimen collected in October; PS = primary spermatocyte. B. Seminiferous tubule in stage 3 in early February; SS = secondary spermatocytes. C. Magnification of a tubule (stage 5) showing several nutritive (Sertoli) cells (SE) and transforming spermatids (TS) at the luminal margin. D. Portion of a tubule (stage 6) from a specimen collected in late March; SP = sperm. Scale lines in A and C also refer to B and D, respectively.
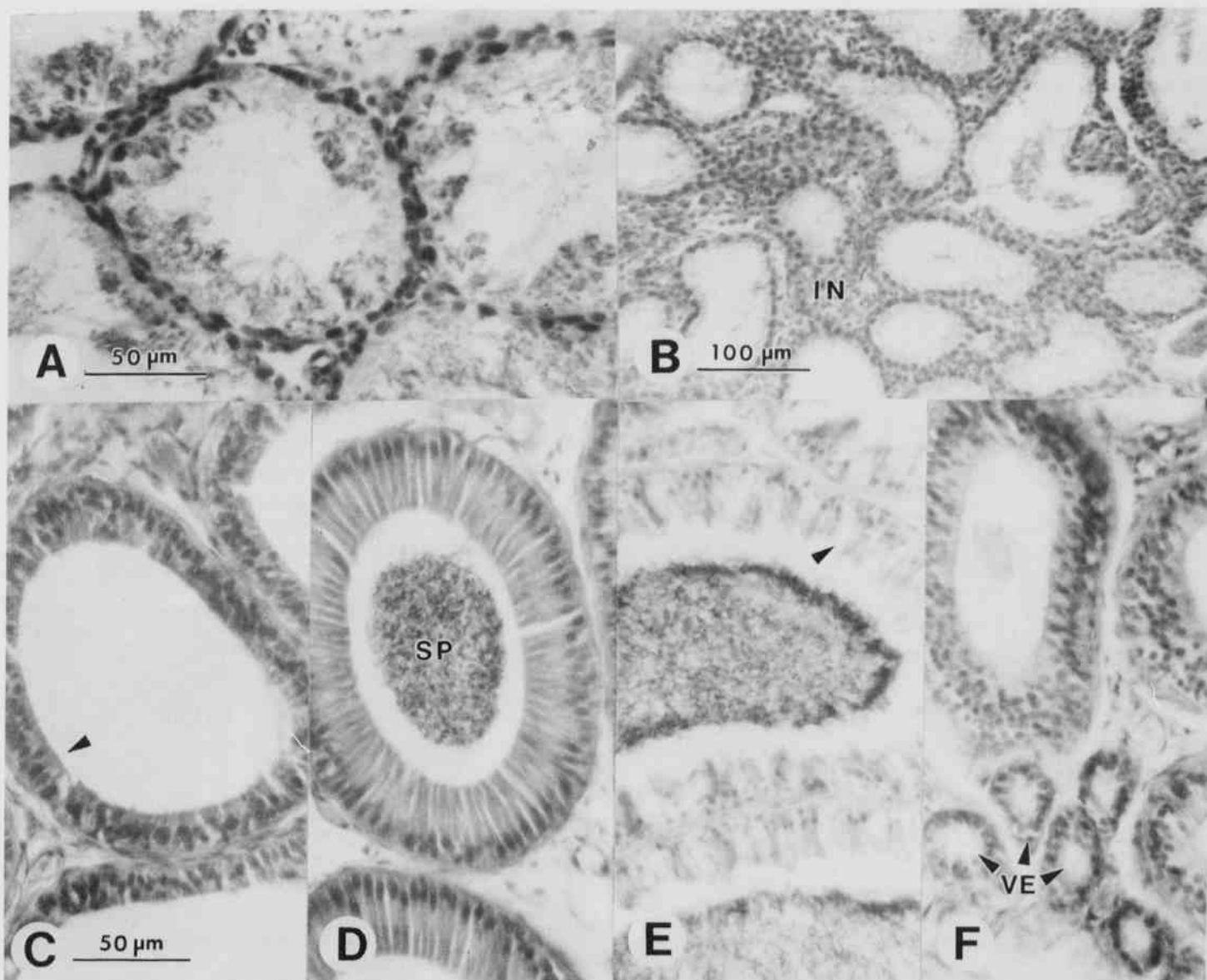
Fig. 2. Photomicrographs of seminiferous (A and B) and epididymal tubules (C-F) of *Eumeces anthracinus pluvialis* collected from Arkansas. A. Seminiferous tubules in stage 7 in late March specimen. B. Section showing completely-regressed testis in stage 8 (early April). Empty tubules are surrounded by interstitial cells (IN). C-F. Epididymal tubules showing cyclic nature of the columnar epithelial cells (arrows) from low (C) to tall (D) and then heteromorphic (E) to pseudostratified (F). See text for further explanations. VE = vas efferens. Scale line in C refers also to D-F.

There were some minor size differences between the two skinks when mean values (according to spermatogenic stages) were matched. In both species the maximum diameter of epididymal tubules was reached during stage 6. Major differences were apparent in the timing and duration of the testicular cycles between the two skinks.

For example, Fig. 4 illustrates the degree of synchrony in spermatogenic stages between the two species. The time of sperm release from the testis (Stage 6) can be inferred as an approximation of the mating season for the species. Most male coal skinks exhibited stage 6 testes during March and April, whereas the same stage in five-lined
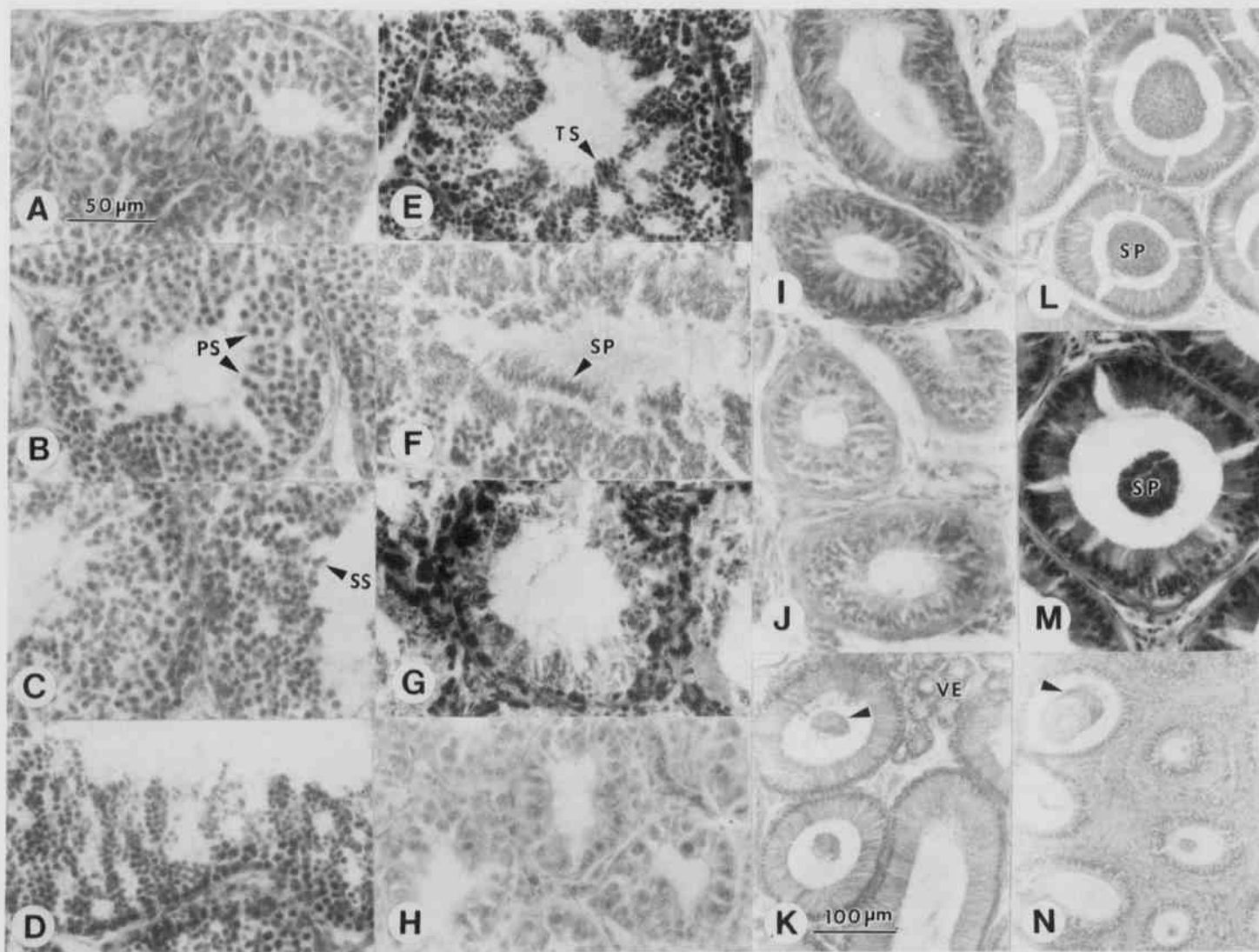
Fig. 3. Photomicrographs of seminiferous (A -H) and epididymal tubules (I - N) of *Eumeces fasciatus* collected in Arkansas. A- H. Spermatogenic stages 1-8, respectively; scale line in A the same for A-J, M; line in K the same for L and N. Abbreviations are the same as in Figs. 1 and 2. I-N. Spermatogenic stages corresponding to the epididymal tubules are: 2-I, 1-J, 5-K, 6-L, 6-M, and 7-N. See text for histological explanations.

skinks occurred in April and May. Animals entering over-
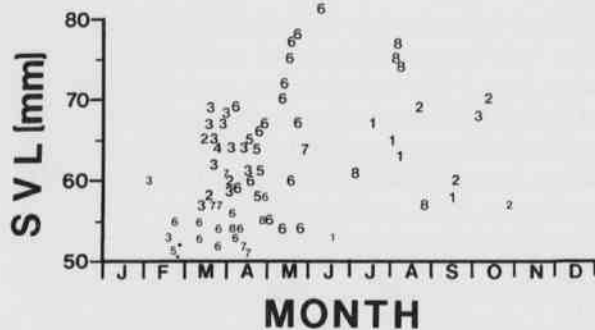wintering retreats had testes in stage 2.

Fig. 4. Spermatogenic stages in *Eumeces anthracinus pluvi-
alis* (small numerals) and *Eumeces fasciatus* (large numer-
als) as a function of body size (SVL) and date of collec-
tion. Asterisk denotes skink with and SVL of 50 mm
exhibiting spermatogenic stage 5.

Ovarian Cycle in **Eumeces anthracinus pluvialis** *and
Comparisons with* **Eumeces fasciatus**.--Female *E. a. pluvi-
alis* emerge from hibernation in northern Arkansas in
early March with ovaries containing many white-to-
opaque, non-vitellogenic ova. Vitellogenesis begins imme-
diately thereafter; Fig. 5 shows the average diameter of
vitellogenic ova for females ≥ 54 mm SVL (the approxi-
mate minimum adult size in females). The largest ova
averaged 6.5 mm in diameter; vitellogenic ova require
around one month to reach maximum size. No females
had vitellogenic ova later than 29 April, whereas females
had oviductal eggs as early as 9 April (Fig. 6). There was
little size difference between females containing vitel-
logenic ova (60.0 ± 1.1 mm) and those containing oviduc-
tal eggs (56.0 ± 1.3 mm). The largest female with oviduc-
tal eggs measured 66 mm in SVL, and no ovigerous
females were collected after mid-May. The ovarian cycle
in this species lasted a little over two months. A common
regression equation comparing all clutch size (CS) data
and SVL was as follows: CS = 19.809 + 0.497SVL; a statis-
tically significant positive relationship (r = 0.53; *P* < 0.05)
was found between CS and SVL; this indicated that as
SVL increased by 1.8 mm, there is a concurrent increase

Table 1. Dimensions (in μm) of seminiferous and epididymal tubules according to spermatogenic stage in *Eumeces anthrac-
inus pluvialis* (above) followed by comparisons with *Eumeces fasciatus* (below).

Spermatogenic Stage	No. of Specimens	Seasonal Occurrence	Mean Perimeter ± 2SE		Mean Epithelial Height ± 2SE	
			Seminiferous Tubules	Epididymal Tubules	Seminiferous Tubules	Epididymal Tubules
1	-	-	-	-	-	-
2	1	October	194.2 ± 7.5 (159.1 - 231.4)	-	63.1 ± 7.3 (46.2 - 119.4)	-
3	2	February	393.1 ± 11.0 (337.2 - 452.8)	281.1 ± 11.9 (220.5 - 338.3)	51.8 ± 3.2 (38.5 - 65.4)	17.7 ± 12.6 (15.4 - 19.2)
4	-	-	-	-	-	-
5	2	February	441.4 ± 20.6 (312.7 - 529.6)	287.5 ± 8.6 (254.9 - 325.6)	65.4 ± 2.7 (57.8 - 73.2)	36.2 ± 2.1 (30.8 - 42.4)
6	8	Late February - Late April	423.8 ± 18.1 (334.9 - 536.8)	388.8 ± 18.1 (322.2 - 531.9)	61.3 ± 1.8 (50.0 - 65.4)	38.1 ± 1.8 (30.8 - 42.4)
7	3	Late March - Mid-April	271.2 ± 10.4 (223.2 - 338.8)	329.9 ± 8.3 (281.5 - 368.2)	28.3 ± 2.9 (19.2 - 42.4)	31.6 ± 3.2 (23.1 - 34.6)
8	2	Early April - Late April	180.2 ± 8.6 (148.6 - 242.3)	295.1 ± 13.8 (240.6 - 338.7)	14.1 ± 1.0 (9.5 - 19.0)	20.7 ± 12.4 (15.2 - 26.6)
Eumeces fascitatus						
1	3	Mid-July - Late September	221.9 ± 9.7 (174.8 - 309.3)	169.6 ± 18.7 (136.6 - 197.6)	-	20.9 ± 2.3 (17.1 - 26.6)
2	4	Late August - Mid-March	360.3 ± 7.4 (292.6 - 404.6)	190.6 ± 6.6 (155.7 - 218.4)	-	21.9 ± 0.7 (19.0 - 24.7)
3	4	Mid-March - Mid-April	471.2 ± 17.3 (376.9 - 545.1)	241.1 ± 11.3 (196.7 - 288.7)	-	22.4 ± 0.9 (20.9 - 24.7)
4	1	-	-	-	-	33.2 ± 1.7 (30.4 - 34.2)
5	4	Late April - Early May	438.8 ± 10.3 (367/4 - 508.8)	323.4 ± 9.4 (272.7 - 374.8)	-	46.9 ± 2.1 (41.8 - 53.9)
6	5	Mid-April - Early June	484.1 ± 16.8 (389.9 - 600.3)	477.5 ± 18.0 (397.1 - 589.9)	-	50.5 ± 2.1 (38.5 - 57.8)
7	5	Late May - ?	263.6 ± 6.3 (230.6 - 304.3)	337.9 ± 12.9 (299.5 - 384.4)	-	37.2 ± 1.4 (34.6 - 42.4)
8	3	Early August - Late August	234.8 ± 13.0 (165.6 - 280.5)	295.1 ± 13.8 (240.6 - 338.7)	-	14.7 ± 1.8 (7.7 - 19.2)

of one in CS. By subjecting the regression residuals from the correlation to a Mann-Whitney rank sum test (to provide a size-free comparison), no statistically significant difference ($T = 325$; $P = 0.313$) was found between CS as estimated using females with vitellogenic follicles ($\bar{x} = 10.5 \pm 1.2$; 5-17; $n = 27$) and CS as determined with oviductal eggs ($\bar{x} = 9.6 \pm 0.7$; 8-13; $n = 21$). The average CS using both methods was 10.1 ± 1.6 (5-17; $n = 43$). Nevertheless, the coefficient of determination ($r^2 = 0.28$) predicts that only 28% of the variability in CS is explained by its linear relationship to SVL.

ovarian follicles (AOF) were observed in several females with enlarged vitellogenic ova. For example, a female (65 mm in SVL collected 14 April) whose 12 ova averaged 2.4 mm in diameter exhibited 5 AOF. The difference between the two estimates of CS may be the result of AOF. Egg clutches ($n = 5$; 7-10; $\bar{x} = 8.2$) accompanied by brooding females were discovered under rocks and inside of rotting logs from early June to early July. The grand mean CS found by combining counts based upon oviductal eggs and laid eggs averaged 8.3 ± 0.8. In this case the correlation between CS and SVL ($r = 0.49$; $P > 0.05$) was not significant.
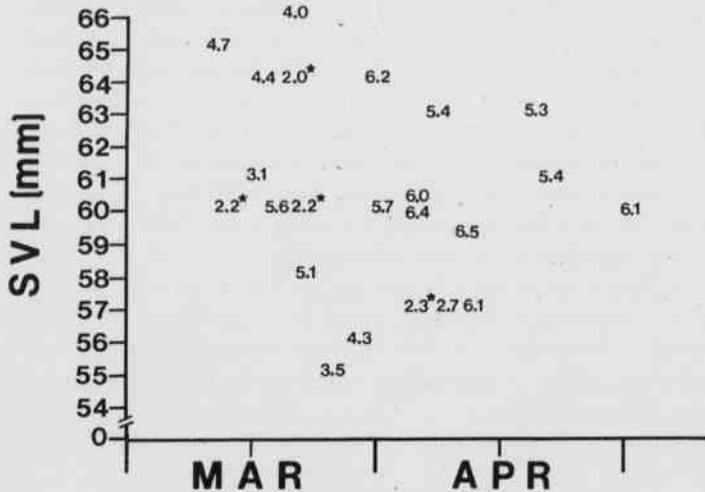

Fig. 5. Average diameter of vitellogenic ova per female as shown as a function of body size (SVL) and date of collection in *Eumeces anthracinus pluvialis* from Arkansas. Asterisk denotes females with a majority of non-vitellogenic ova.
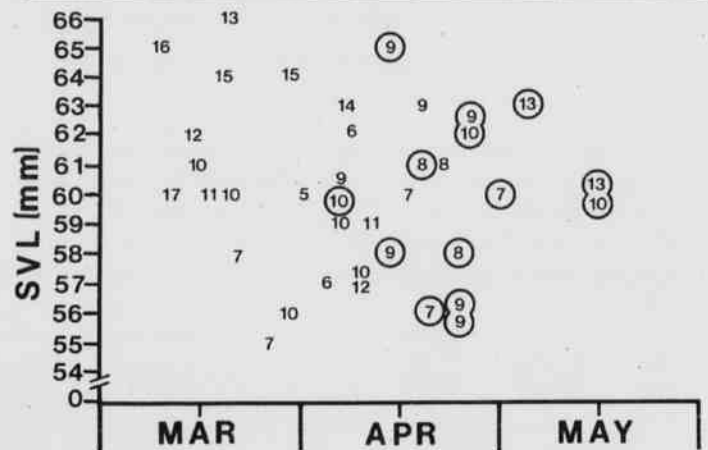

Fig. 6. Clutch size as a function of body size (SVL) and date of collection in *Eumeces anthracinus pluvialis* from Arkansas. Circled numerals represent counts of oviductal eggs and those without circles are counts of vitellogenic ova.

The ovarian cycle of *E. fasciatus* is illustrated in Fig. 7. Female *E. fasciatus* emerge from overwintering dens sometime in March in northern Arkansas; however, ovarian enlargement does not accelerate for nearly a month. A dramatic increase in vitellogenic activity occurred in late April, especially in older females. No females contained vitellogenic ova later than mid-June. Minimal adult body size was estimated to be 60 mm in SVL; no female was larger than 69 mm in SVL. Ovulation commenced by mid-May in females of all sizes. One ovigerous female (60 mm in SVL) was captured on 19 June. Clutch size based on counts of vitellogenic ova averaged 10.0 ± 0.7 (7-15; $n = 34$), whereas CS based upon counts of oviductal eggs averaged 8.4 ± 1.0 (6-12; $n = 13$). A significant positive correlation ($r = 0.51$; $P < 0.01$) was found between CS (using vitellogenic ova) and SVL, and a regression equation, $CS = 13.8660 + 0.3763SVL$, was calculated. This relationship predicts that for every increase of 3.1 mm in SVL, there is a concordant gain of one in CS. Atretic

The major difference between the ovarian cycles of the two skink species was the timing of vitellogenesis. In *E. a. pluvialis* yolk deposition began by mid-March and extended until late April, whereas this process began in late April and extended until mid-June in *E. fasciatus*. Although both species differed in maximum adult body size (*E. fasciatus* being larger), the average CS of the two species was very similar.

Timing of the Reproductive Cycles.--Timing of critical reproductive events (i.e., vitellogenesis and spermiation) between sexes in these species was concordant. In *E. a. pluvialis*, the synchrony between vitellogenesis in females and sperm production in males lasted from early March to late April. In *E. fasciatus*, these events occurred from mid-April to mid-June. Consequently, the mating period between the two species overlapped marginally (see discussion).
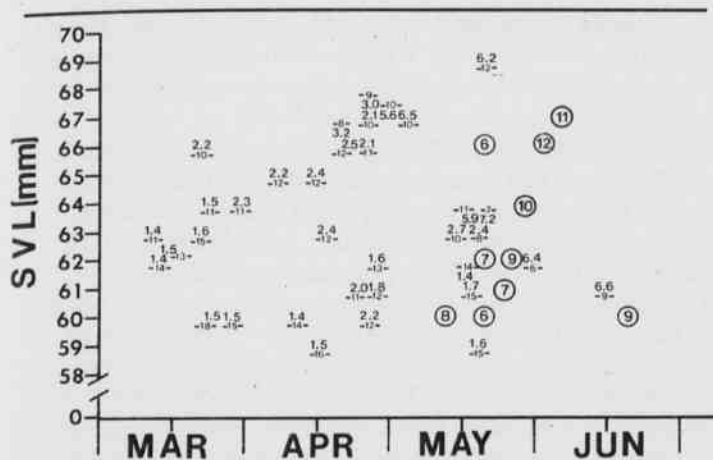
Fig. 7. Reproductive characteristics of female *Eumeces fasciatus* from Arkansas (samples selected from collections made from 1984 - 1993) as a function of body size and date of collection. Large numerals with decimals represent the average diameter of ovarian follicles per female and are matched with small numerals within dashes which represent the total number of ovarian follicles > 1.0 mm in diameter of each female. Circled numerals denote the number of oviductal eggs of individual females.

Discussion

Clutch size, time of mating, and oviposition are the best documented reproductive characteristics in *E. a. pluvialis*. In Missouri, Anderson (1965) mentioned a single clutch of 8 eggs laid on 27 May, and Sexton (1984) collected a clutch in the process of hatching on 7 July. Collins (1993) noted that clutches of from 8-11 eggs were laid between 21 and 23 June in Kansas. A clutch of five eggs was reported for northern Louisiana (Dundee and Rossman, 1989). Although no egg clutches of *E. a. pluvialis* were discovered during the present study, my data suggest that the month of May is the most likely time for oviposition to take place in Arkansas. Mount (1975) observed a pair of captive coal skinks copulating in March in Alabama; this observation would occur within the period of spermiation in Arkansas. Because of the paucity of reproductive data on this species, other authors (e.g., Johnson, 1987) have presumed that reproduction in this species was comparable to *E. fasciatus*, or they reported its reproduction using published data outside of a localized geographic region. In fact only the stages of the ovarian and testicular cycles in *E. a. pluvialis* closely resemble those of *E. fasciatus*.

The reproductive characteristics in *E. fasciatus* have been reported from many parts of its range (Reynolds, 1943; Fitch, 1970, 1985; Sexton, 1984; Vitt and Cooper, 1986; Shadrix et al., 1994). Reynolds (1943) presented his-

tological stages of the testicular cycle for *Eumeces fasciatus* from several states; however, he divided the cycle according to monthly intervals rather than spermatogenic stages and probably included other *Eumeces* species in his analysis. Both the present study and that of Reynolds indicated that May was the primary month for spermiation and that seminiferous and epididymal tubules reached their maximum diameter during May. An average CS of 8.4 (6-10; n = 6) was given for females from Oklahoma and Arkansas by Fitch (1985); a recent report for Oklahoma (Shadrix et al., 1994) included a CS averaging 10.8 (7-14; n = 10) in females 55 - 70 mm in SVL. In South Carolina, Vitt and Cooper (1986) reported a CS of 8.6 (6-11; n = 7) in females 60 - 70 mm in SVL. In 24 females (65 - 70 mm in SVL) from Kansas, the average CS was 8.2 (Fitch, 1970). These estimates are similar to the 8.3 eggs per clutch for Arkansas females of comparable size. In general, older and larger females produce more eggs than younger and smaller females (Fitch, 1954; Vitt and Cooper, 1986), although the correlation between CS (using oviductal and laid eggs) was not significant in neither the Arkansas sample (n = 18) nor the South Carolina sample (n = 28).

As a rule, synchronization of male and female reproductive cycles occurs in most oviparous lizard species (e.g., see Shrank and Ballinger, 1973; Trauth, 1979); yet, there are some exceptions within viviparous species in montane regions in which females will store sperm for several months (Mendex de la Cruz et al., 1988) prior to fertilization. This phenomenon may even occur in some *Eumeces* (Guillette, 1983) which have an asynchronous cycle, where timing of fertilization occurs soon after ovulation (or, in effect, after copulation), and sperm storage is not utilized or is of little importance. Male *E. a. pluvialis* are reaching maximal production of sperm in March, whereas male *E. fasciatus* are reaching this peak in May. There are numerous advantages to synchronization of courtship and mating with to ovulation. The ovigerous period (Figs. 6 and 7) in the present study tends to match the peak in spermiation (Fig. 4) for both species and, thus, illustrates a maximizing of reproductive efficiency.

In conclusion, it is apparent that the timing and duration of the reproductive season in *E. a. pluvialis* differ markedly from that of *E. fasciatus*. Moreover, the peak in breeding condition and sexual activity in each species appears to be highly synchronized for both sexes. This peak showed little interspecific overlap at the level of species groups. Males of species within *Eumeces* of the *fasciatus* group can discriminate cloacal ordors (via tongue-flicking behavior) between conspecifics (and heterospecifics) and can identify sexual receptivity (Cooper and Vitt, 1986). Under normal circumstances, interspecific aggression in *Eumeces* occurs infrequently (Vitt and Cooper, 1986). Evolutionary differences in behavior, microhabitat preferences, and activity may restrict social

contact between these skinks in Arkansas; however, at present, any social or competitive interactions between the two species remain to be determined in Arkansas.

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