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**Sexual Maturation and Variability of the Reproductive
System in Young Shrews (*Sorex L.*)
in the First Calendar Year of Life**

**Dojrzewanie i zmienność aparatu płciowego
młodych ryjówek (*Sorex L.*)
w pierwszym kalendarzowym roku życia**

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I. INTRODUCTION

Until recently it was generally accepted that shrews (*Sorex L.*) and (*Neomys* K a u p.) do not attain sexual maturity in the first calendar year of their life. In recent years B a z a n (1955) demonstrated the groundlessness of this assumption with regard to the European water-shrew (*Neomys fodiens* P e n n a n t). This authoress showed that all young water shrews from the first litter attain sexual maturity immediately after leaving the nest. This applies both to males and females. In the following months the testes of these males undergo regression. No progressive changes are observed in the autumn young. Both these groups of water shrews attain full sexual maturity in the spring of the following calendar year.

Brambell (1935) was the first to draw attention to the possibility of the sexual maturation of young shrews, describing a single instance of very late (September) first pregnancy in *S. araneus* L. This shrew weighed 11 gm. and had 10 embryos in the late blastocyst stage. The state of the lactic glands indicated that the pregnancy was its first. The author presumes that „it is probable, from its large size, that it was born the previous year, but it is possible that it was a very exceptionally developed animal born in the same season”. The somewhat excessive body weight for a young shrew, which in addition was in the relatively early period of pregnancy, rather contradicts the assumption that it was a young female. Brambell himself treats this as a deviation from normal development, discussing this case in the section entitled „Abnormalities”.

From the literature available on this subject it appears that the occurrence of sexual maturation in unquestionably young shrews was recorded for the first time by Stein (1952). This author described a pregnant young female of *S. araneus* caught on September 10th 1951. A few months later a similar case was described by Borowski & Dehnel (1952). This shrew (coll. no. 13439), caught on Sept. 6th 1952, weighed 7.35 gm., and was in the first half of pregnancy. The authors accept the possibility of sexual maturation of young shrews only in very favourable circumstances, and only during the early part of autumn. They do not, however, assume „that the fact that shrews are capable of reproduction in the first year of their life has any significance (apart from a negative one) on the population dynamics of this species. These will as a rule be late litters, and their survival to the spring of the following year will, in our opinion, be somewhat problematical”.

Stein (1954) devotes slightly more attention to this problem, as incidental to the analysis of the changes in the pelage of *Insectivora*. He records 12 young females of *S. araneus* L., pregnant and nursing, and 8 with distinctly increased dimensions of the sexual apparatus, but without distinct swellings from the placentas in process of formation. It appears from my histological investigations discussed below, that those were also, at least in part, pregnant females in the pre-implantation stages.

Dunajeva (1955) also describes several pregnant females, not exhibiting distinct features of animals which have survived the winter (old adults), and therefore probably young shrews. This authoress, like Borowski & Dehnel (1952) assumes that a certain number of the young females may mature at the end of summer or the beginning of autumn (but does not, however, cite the work of the above authors).

No-one has as yet established that sexual maturation of males shrews takes place in the first calendar years of their life.

Although under natural conditions the phenomenon of attainment of sexual maturity in young shrews may take place, according to Dehnel (1952) this is a regular occurrence under laboratory conditions. This author stated that over a period of 3—4 months from the time of starting the rearing of young shrews (*S. araneus* L.), all males had developed testes, which was expressed

by a considerable swelling in the inguinal area. The process of sexual maturation must therefore start much earlier. It is probable that the females also were capable of being fertilised. Dehnel did not carry out histological investigations, nor did he trace the course of this process. After the death of the animals, autopsy revealed the enlargement of the whole female sexual apparatus. In Białowieża, during the years 1956—57, complete maturity of Graafian follicles was found and readiness for ovulation in the shrews living under laboratory condition.

Dehnel (1952) explains the facts of sexual maturation of young shrews in the laboratory by the optimum feeding conditions, and the sporadic nature of maturation in these animals under field conditions by the insufficiency of food in the second half of the summer and early autumn.

Incidental remarks on the subject of sexual maturation of shrews in the first calendar year of their life can be found in the works by Wolska (1952), Bazan (1956), Crowcroft (1957), Tarkowski (1957) and others.

In June 1954, (before the second work by Stein (1954) appeared), several sexually active young female shrews (*Sorex araneus araneus* L. and *Sorex minutus minutus* L.) were found in the collections made from the Białowieża National Park. The first young nursing shrew (*S. araneus*) was found in the collections from Białowieża in 1949 (Table 10). In the succeeding years greater attention was paid to this phenomenon, and 34 specimens of sexually active shrews were found (*S. araneus* — 18, *S. minutus* — 15 and *S. caecutiens* — 1), from among numerous specimens.

This material made it possible to carry out a more comprehensive study of the problem of sexual maturation in shrews in the year of their birth.

The aims of the present work were as follows: 1. morphological analysis of variations in the female and male sexual apparatus in young shrews, paying special attention to progressive tendencies which might, at a later phase, lead to sexual maturity; 2. analysis, as far as possible from all standpoints, of the cases found of sexual maturation of young shrews and of the phenomena accompanying this process, and 3. investigation of the problem of the influence of sexual maturation in young shrews on the population dynamics of these animals.

II. MATERIAL AND METHODS

The material analysed in this work comes from the collection of the Forestry Research Institute (1949—1952) and the Mammals Research Institute of the Polish Academy of Sciences (1952—1958). Captures were made over the entire area of the Białowieża National Park. The whole material is preserved in alcohol and kept in the Mammals Research Institute in Białowieża.

A total of 5076 shrews, belonging to the three species mentioned above, was examined. The distribution of material over the various years is given in Table 1.

All specimens were examined under a dissecting microscope, and as

a result of this examination 21 cases of sexually active young females (pregnant or nursing) were discovered in the initial phase of the work. With individuals suspected of being in the pre-implantation stages of pregnancy (thickening of the uterus and vagina) the ovaries were subjected to histological examination, which made it possible to discover a further 13 sexually active young females. This is a typical example of the necessity for microscopic examination in ecological works apparently unconnected with microscopic anatomy. This was unquestionably the reason why Dunajeva (1955) overlooked all the early pregnancies. Also the data given by this authoress in regard to the quantity of corpora lutea, being based only on observations made without microscope, would appear to be open to question.

Measurements of the female sexual system¹⁾ were made under a dissecting microscope, using a measuring ocular. The results are given in mm. with accuracy of 0.01 mm.

Table 1.

Comparison of material examined.

(Young shrews, ♂♂+♀♀ caught between June 1st and October 31st.)

Species \ year	1949	1950-1952	1953 ^y	1954	1955	1956	1957	1958	Total
<i>Sorex araneus</i> L.	362	200	363	1245	1373	193	329	215	4280
<i>Sorex minutus</i> L.	-	-	-	168	204	82	106	57	617
<i>Sorex caecutiens</i> Laxmann	-	-	-	78	47	24	18	12	179

¹⁾ Only young females given for years 1949—1953.

The following dimensions of the female sexual apparatus were taken into consideration — 1. the sum of length of uterine horns; 2. length of vagina — from point of contact with uterine horns to the sexual orifice; 3. maximum thickness of vagina at its proximal part (at base of uterine horns), and 4. size of area of cross-section of ovary, calculated according to formula for ellipse field — $ab\pi$, in which the letters a and b mark half of the maximum length and breadth of the ovary.

Measurements were made after the animal had been stretched out on a dissection plate, and the connecting tissue links of the sexual apparatus had been loosened so as to leave it as slack and as little deformed in shape as possible. Each measurement was made three times. The arithmetical average of these figures was taken as the final result.

The testes of the males were measured with technical sliding calipers, with accuracy of 0,1 mm. Size of area of their cross-section was calculated according to the formula for ellipse field given above.

¹⁾ Measurements of the uterus, vagina and ovaries, set out in the tables given below, were made by Miss B. Bator, to whom my thanks are due.

Apart from the dimensional data, the material from the period 1954—1958 was divided into three classes according to the size of the sex organs. The individual classes were assessed visually, which, with practice and also a knowledge of the scale of individual variation of these organs, is sufficiently accurate to make a general classification of the material possible. The following classes were differentiated:

I. uterus small, or in regressive state, occurring in animals not exhibiting any symptoms of sexual maturation. Vagina thin.

II. uterus medium, slightly enlarged, vagina thickened, especially at the base of the uterine horns.

III. uterus considerable enlarged, and thickened as though inflated. Vagina thick, especially in the anterior section. Thickness of uterus and vagina is about twice as great as that in individuals in class I.

This classification has been applied in Białowieża since 1948. All the identifications were, however, checked personally by the author.

The size of thymus of sexually active young female shrews was defined according to the method applied by B a z a n (1952, 1956). Three classes were differentiated: small, medium and large thymus.

The age of the animals was identified on the basis of the amount of wear exhibited by the teeth, by comparison of each specimen with a series selected as standards (P u c e k, 1955). Each age class represents three months of life in the field. The age is estimated in units within the limits of each class, with accuracy of up to one month.

A series of 97 ovaries of *S. araneus* and 16 of *S. minutus* were prepared for histological examination. The paraffin sections were stained with haematoxylin and eosin.

III. CHANGES IN THE YOUNG FEMALE SEXUAL SYSTEM

Individual and seasonal variation of the uterus, vagina and ovaries was examined in young females of *S. araneus*. Only this species was dealt with in these investigations, as insufficient material was available to consider the two remaining species of the genus *Sorex* L., but the probability that corresponding changes occur in them has also been investigated.

The genetic system of tables (B o r o w s k i & D e h n e l, 1952) has been used in this work, thus enabling an analysis to be made of all phenomena occurring in the life cycle of the shrew.

Young shrews from the first spring litters make their appearance in the area and begin to fall into the traps sporadically as early as at the end of May, but more frequently in the first days of June. These are, of course, the youngest individuals which can be obtained by capture. Their maximum age at the end of June does not exceed one month. At this period they constitute 100% of all young shrews caught.

During the following months there is a continual exodus from their nests of the young shrews from the summer and autumn litters. The percentage of individuals in the age group not exceeding one month decreases from July to October inclusively, both as a consequence of their being absorbed into the mass of older individuals, and of the decrease in the number of young per litter towards the end of the breeding season.

It has so far proved impossible to differentiate between litters, as the process of appearance in the area of young shrews is a continuous one. This, of course, makes it difficult to determine the number of litters produced over the course of a year, and impossible to analyse the phenomenon of sexual maturation of young shrews from the successive litters (cf. Tarkowski, 1957).

Table 2.

Variation in size of cross-section of ovary (ab π) in young females of *S. araneus* (1949—1954).

Months	mm. ³											no.	Av.
	0.1-	0.2-	0.3-	0.4-	0.5-	0.6-	0.7-	0.8-	0.9-	1.0-	1.1-		
V	-	-	-	3	1	1	1	2	1	-	-	9	0.66
VI	-	8	22	39	48	26	17	8	2	2	2	174	0.55
VII	7	42	124	121	108	52	27	11	2	4	1	499	0.47
VIII	4	54	108	105	87	33	19	9	4	2	-	425	0.46
IX	1	15	28	36	24	6	5	1	-	-	-	116	0.44
X	-	7	14	6	3	4	1	-	-	-	-	35	0.40
V - X	12	126	296	310	271	122	70	31	9	8	3	1258	0.48

An index of the progressive changes connected with the sexual maturation of shrews is to a certain extent the increase in the size of Graafian follicles, which were fully described in Brambell's work (1935). The macroscopic external manifestation of this process is the increase in the dimensions of the ovaries. The variations in size of the gonads in young females captured during the period 1949—1954 are given in Table 2. From this table it appears, contrary to expectations, that the youngest specimens possess the largest ovaries, immediately after leaving the nest, that is, in May and June. In 1953, after the early spring, the young shrews began falling into the traps as early as in the last days of May. The average size of the ovary for this series of specimens is even greater than for the remainder from June. In the following months there is a slight, but continuous decrease in the average size of ovary. In this period the gradual fall in the quantity of individuals in the higher classes of variability is also characteristic. The number

of specimens measured is so large that there is no question of an error of a statistical nature.

With young females of *S. araneus*, significant fluctuations in the divisions of variability are observed in the various years, and especially in the monthly averages of ovary size (Table 3). Variations in the successive months of the life cycle contribute to the total arithmetical averages calculated from the whole material in

Table 3.

Divisions of variation and arithmetical averages of size of cross-section of ovary in young females of *S. araneus*.

Years Months	1949	1950-52	1953	1954
V	-	-	0.44 - 0.97 / 0.66 / n = 9	-
VI	0.20 - 0.71 / 0.44 / n = 44	0.31 - 1.04 / 0.57 / n = 14	0.35 - 1.18 / 0.61 / n = 70	0.34 - 0.89 / 0.56 / n = 46
VII	0.16 - 0.97 / 0.46 / n = 123	0.20 - 0.73 / 0.44 / n = 62	0.13 - 1.04 / 0.46 / n = 163	0.20 - 1.13 / 0.57 / n = 151
VIII	0.16 - 1.04 / 0.44 / n = 169	0.20 - 0.79 / 0.42 / n = 55	0.26 - 0.90 / 0.52 / n = 81	0.19 - 1.04 / 0.46 / n = 120
IX	0.18 - 0.79 / 0.41 / n = 15	0.20 - 0.55 / 0.38 / n = 41	0.26 - 0.86 / 0.50 / n = 31	0.24 - 0.78 / 0.47 / n = 28
X	0.24 - 0.79 / 0.40 / n = 7	0.22 - 0.63 / 0.36 / n = 16	0.28 - 0.50 / 0.38 / n = 5	0.25 - 0.63 / 0.43 / n = 7
XI	-	0.19 - 0.63 / 0.36 / n = 8	-	-
V - XI	0.45	0.42	0.51	0.49

the given year. They appear to a certain extent to be correlated with the population dynamics of *S. araneus* L. For instance, in the Białowieża National Park in 1953, and in particular in 1954, the shrew population was in a phase of progressive development leading to the mass appearance of these animals in 1955 and 1956. This was expressed, inter alia, in the considerable preponderance of females over males (Pucek, 1959). In these years the ovaries

Table 4.
Variation in thickness of vagina in young females of *S. araneus* L.
(1949—1954).

mm. Months	mm.										no.	Av.
	0.50-	0.65-	0.80-	0.95-	1.10-	1.25-	1.40-	1.55-	1.70-	1.85-		
VI		8	36	29	36	28	27	8	5	2	179	1.179
VII	3	41	136	183	78	51	8	1	1		502	1.016
VIII	4	33	113	165	68	35	5		1		424	1.008
IX		21	48	35	7	8					119	0.936
X	3	7	9	14	4	1					35	0.909
XI	1	3	7	2	1						14	0.859
VI -XI	11	113	349	425	194	123	40	9	7	2	1273	1.024

Table 5.
Divisions of variation and arithmetical averages of thickness
of vagina in young females of *S. araneus* L.

Years Months	Years			
	1949	1950-52	1953	1954
VI	0.73 - 1.66 / 1.14 / n = 44	0.80 - 1.66 / 1.15 / n = 15	0.66 - 1.80 / 1.10 / n = 74	0.66 - 1.80 / 1.20 / n = 46
VII	0.66 - 1.80 / 1.09 / n = 122	0.66 - 1.33 / 0.99 / n = 62	0.50 - 1.40 / 0.95 / n = 168	0.66 - 1.46 / 1.03 / n = 150
VIII	0.66 - 1.73 / 1.04 / n = 166	0.73 - 1.33 / 1.02 / n = 56	0.50 - 1.33 / 0.93 / n = 83	0.50 - 1.53 / 1.02 / n = 119
IX	0.66 - 1.26 / 0.92 / n = 16	0.66 - 1.33 / 0.94 / n = 43	0.66 - 1.13 / 0.89 / n = 33	0.73 - 1.33 / 0.99 / n = 27
X	0.50 - 1.33 / 0.96 / n = 8	0.50 - 1.13 / 0.85 / n = 16	0.73 - 1.06 / 0.87 / n = 5	0.93 - 1.13 / 1.02 / n = 6
XI-XII	-	0.60 - 1.13 / 0.85 / n = 8	-	0.66 - 1.00 / 0.87 / n = 6
VI-XII	1.06	0.98	0.97	1.04

of young females were relatively larger than in the previous years. Nevertheless sexual maturation in young shrews did not take place in 1953. This may have been connected with the worse weather

conditions at the end of spring and beginning of summer in this year, than in the previous and following years.

1950 and 1952 constituted a period of very considerable drop in population (decrease in animals caught) of *S. araneus* (cf. P u c e k, 1959). A decrease in the annual averages of ovary dimensions is observed during this period also.

The variability in thickness of vagina in *S. araneus* (Table 4) takes a very similar form. From June onwards a distinct decrease begins in the monthly averages of this dimension, while the differences are even greater here than in the case of variations in the ovary dimensions. In the autumn the absence of individuals with large vagina dimensions is characteristic, as is also the decrease in the number of individuals in classes higher than 1.10 mm. The lower limits of division of variability in the various months are maintained at a constant level, whereas the upper limits decrease. As a result, the variations of this feature distinctly decrease from summer to autumn. The distribution of figures in table 4 causes the total variation in thickness of vagina, similarly to the size of the ovary, to deviate from the normal curve. The total arithmetical average shifts decidedly in the direction of greater values, while the greatest numbers of individuals are aggregated in classes lower than the average (0.8—1.09 mm). The divisions of variations higher than 2 mm. now include pregnant and nursing individuals. In June therefore the thickness of the vagina reaches the limit of variation in dimensions peculiar to sexually active specimens.

In the various years a shift in the divisions of variations in thickness of the vagina can be observed, and also the corresponding variations in arithmetical averages (Table 5). In certain years (1949 and 1954) they remain at a relatively higher level than in the remaining years (1950—1953). The differences in annual averages are also clearly accented in the different months of the given year.

A similar seasonal variation (from spring to winter) is exhibited by the length of the vagina (Table 6). The diminution in arithmetical averages calculated for the different months from June to October is very distinctly marked here. The lesser deviations of this dimension in the direction of specimens with very thick vaginas is, however, significant. The lower limit of variation in the successive months is subject to very slight fluctuations only within one class 4.00—5.00 mm.

In table 7 considerable fluctuations in this dimension are visible

in the various years. These differences are relatively great, being 1.2 mm.

From the total averages of length and thickness of the vagina, calculated for the various years, it appears that the maximum dimensions of this organ were attained in 1949 and 1956 (Table 5

Table 6.

Variation in length of vagina in young females of *S. araneus* (1949—1954).

Months	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	11.0-	n	Av.
VI	1	21	48	46	39	17	3	3	178	7.50
VII	26	70	150	123	99	31	6	1	506	7.13
VIII	8	65	119	120	86	26	3	—	427	7.20
IX	2	27	43	31	14	2	—	—	119	6.78
X	2	12	7	6	8	1	—	—	36	6.74
VI-X	39	195	367	326	246	77	12	4	1266	7.16

Table 7.

Divisions of variation and arithmetical averages of length of vagina in *S. araneus* L.

Years Months	1949	1950-52	1953	1954
VI	5.00 - 11.00 / 7.40 /	5.00 - 10.00 / 7.09 /	4.80 - 10.20 / 7.52 /	5.33 - 11.23 / 7.69 /
VII	4.66 - 10.66 / 7.67 /	4.13 - 8.66 / 6.08 /	4.13 - 10.00 / 6.65 /	4.33 - 11.00 / 7.65 /
VIII	5.20 - 10.76 / 7.73 /	4.00 - 9.00 / 6.30 /	4.26 - 9.00 / 6.37 /	5.33 - 10.00 / 7.55 /
IX	5.33 - 8.33 / 6.99 /	5.00 - 9.33 / 6.73 /	4.66 - 8.00 / 6.56 /	5.33 - 8.33 / 6.99 /
X	5.00 - 8.66 / 7.62 /	4.66 - 8.33 / 6.24 /	5.33 - 7.00 / 6.49 /	5.33 - 9.33 / 6.99 /
VI - X	7.60	6.38	6.75	7.55

and 7). The size of the vagina is therefore more distinctly correlated with the occurrence of sexual maturation in young shrews than the size of the ovary.

The sum of lengths of the uterine - horus (Table 8) is subject to the smallest variations. This is to be expected, since this organ,

in connection with sexual maturation, increases primarily in thickness. The increase in length of the uterine horns is evident to greater degree after mating, in the first phase of pregnancy, and later on, with the growth of the developing embryos.

Table 8.

Variation of sum of length of uterine horns in young females of *S. araneus*.

mm Months	mm								n	Av.
	4.0-	5.0-	6.0-	7.0-	8.0-	9.0-	10.0-	11.0-		
VI	6	58	97	15	4	-	-	-	180	6.23
VII	16	145	234	92	18	2	2	-	509	6.43
VIII	8	111	219	67	19	1	-	-	425	6.45
IX	7	31	62	15	4	1	-	-	120	6.34
X	2	7	20	3	3	-	-	-	35	6.44
VI-X	39	352	632	192	48	4	2	-	1269	6.40

Table 9.

Divisions of variation and arithmetical averages of sum of length of uterine horns in young females of *S. araneus* (1949-1954).

Years Months	Years			
	1949	1950-52	1953	1954
VI	4.66 - 8.00 / 6.40 /	5.32 - 8.29 / 6.56 /	4.66 - 7.33 / 6.00 /	4.66 - 8.00 / 6.28 /
VII *	4.66 - 10.66 / 6.74 /	5.06 - 10.66 / 6.49 /	4.00 - 8.13 / 6.09 /	4.13 - 9.33 / 6.52 /
VIII	5.00 - 8.33 / 6.64 /	5.33 - 8.13 / 6.55 /	4.66 - 9.00 / 6.12 /	4.66 - 8.40 / 6.37 /
IX	4.66 - 8.63 / 6.44 /	5.33 - 9.33 / 6.70 /	4.00 - 7.66 / 5.89 /	5.00 - 8.00 / 6.25 /
X	6.00 - 8.00 / 6.99 /	5.33 - 8.00 / 6.43 /	4.13 - 7.53 / 5.74 /	4.60 - 8.00 / 6.21 /
VI - X	6.65	6.56	6.05	6.41

From tables 8 and 9 it appears that the length of the uterine horns in *S. araneus* does not attain its greatest dimensions in June, but in July and August. In these months several individuals are found, in which the length of the uterine horns exceeds 9.00 mm. They come from all the years examined, and reach the limit of variation of these features in the young sexually active (early pregnancy) females of this species.

Of all the dimensions analysed here the distribution of variations in length of uterine horns most closely approaches the normal.

From the above review of variations in certain measurements of the female sexual apparatus in young shrews (*S. araneus*) it appears that the greatest dimensions are found in June. Towards autumn they undergo regression (exceptionally the length of the uterine horns, by comparison with specimens from June, increases slightly in July and August). It would seem that age and seasonal variations of this kind is the result of developmental processes of the nest-life period, which still exhibit themselves in very young, but already self-sufficient shrews. This developmental tendency may lead to the attainment of sexual maturity and mating by young females of *Sorex* L. This is true of the first spring litter only (cf. page 282). Young shrews born during the summer and autumn do not attain such considerable size of the female sexual system as the animals caught in May and June, despite the similarity of their ages.

In the various years, depending on the conditions of the bioclimate, we observe fluctuations in the average annual measurements of the female sexual apparatus. This would appear to be correlated to correspondingly varied occurrence of sexual maturation in these animals.

IV. SEXUAL MATURATION OF YOUNG FEMALES IN THE FIRST YEAR OF LIFE

The investigation of the occurrence of sexual maturation in young shrews is based primarily on material obtained from the collections, which were made over the years 1954—1958. A general comparison of all 34 young²⁾ sexually active females, belonging to three species: *S. araneus* L., *S. minutus* L. and *S. caecutiens* Laxmann, is given in table 10.

Full data are given in this table of dimensions, body weight, age, state of sexual activity and size of thymus in these specimens. From table 10 it can be seen that:

1. The sexually active young females of *Sorex minutus*, *Sorex araneus* and also *Sorex caecutiens* are encounte-

²⁾ This number also includes the 3 nursing females of *S. araneus* found by B. Bator in the material collected by the Forestry Research Institute in 1949.

Table 10.
Comparison of sexually mature young female shrews.

No.	No. coll.	Date of capture	Body length in mm.	Weight in grm.	Age class	Size of thymus	Remarks
<i>Sorex araneus araneus</i> L.							
1.	18130	5.6.1957	74	7.000	I ₀	large	Corpora lutea. Small embryos in uterus.
2.	4545	10.6.1954	63	6.500	I ₀	large	5 embryos.
3.	4586	12.6.1954	66	7.150	I ₁	large	4 embryos.
4.	4644	13.6.1954	68	7.900	-	-	Corpora lutea.
5.	4681	16.6.1954	67	7.800	I ₁	medium	6 embryos.
6.	19991	20.6.1958	72	7.200	I ₁₋₂	medium	6 embryos.
7.	FI 8671	9.7.1949	73	10.000	I ₃	small	Lactating female - MG - very large.
8.	16977	10.7.1956	69	10.400	I ₂	small	8 embryos. Lactating.
9.	5298	18.7.1954	62	6.600	-	-	Corpora lutea.
10.	5816	4.8.1954	63	8.000	I ₁	large	Lactating. MG - small.
11.	17071	4.8.1956	70	8.700	I ₂	small	-"
12.	5911	8.8.1954	62	7.850	I ₂₋₃	medium	7 embryos.
13.	14967	11.8.1955	68	9.500	I ₂₋₃	small	Lactating. MG-medium.
14.	FI 10099	18.8.1949	75	8.550	I ₃	small	-"- MG-small.
15.	FI 10148	20.8.1949	68	7.600	I ₂	small	-"- MG-medium.
16.	6373	28.8.1954	67	8.050	II	medium	-"- MG- small.
17.	6436	31.8.1954	65	8.300	I ₁	large	-"- -"
18.	6841	30.9.1954	74	-	II ₁	small	-"- -"
<i>Sorex minutus minutus</i> L.							
19.	4626	12.6.1954	55	3.300	I ₀	-	Enlarged uterus. Corpora lutea.
20.	4679	16.6.1954	55	3.200	I ₁	large	Uterus greatly enlarged. Semen in uterus and vagina.
21.	4709	17.6.1954	56	3.150	I ₁	medium	Enlarged uterus. Corpora lutea.
22.	9065	17.6.1955	53	3.250	I ₀	large	6 embryos.
23.	4725	19.6.1954	53	2.950	I ₀	-"	Enlarged uterus. Corpora lutea.
24.	9272	22.6.1955	53	3.400	I ₀	medium	6 embryos.
25.	9343	24.6.1955	53	2.900	I ₀	-"	5 embryos.
26.	4839	29.6.1954	53	3.470	I ₁	-"	9 embryos.
27.	FI 14121	1.7.1954	54	3.300	-	-"	6 embryos.
28.	16976	10.7.1956	46	2.800	I ₁	-"	7 embryos.
29.	16984	12.7.1956	54	3.400	I ₁	-"	5 embryos.
30.	17024	18.7.1956	52	3.850	I ₁	small	6 embryos. Lactating.
31.	5719	1.8.1954	55	3.750	I ₁	medium	4 embryos.
32.	12097	3.8.1955	57	4.300	I ₂	small	Lactating. MG very large.
33.	6904	6.10.1954	56	3.680	II ₂	small	Lactating.
<i>Sorex caecutiens karpiński</i> Dehnel							
34.	5852	6.8.1954	56	4.800	II	medium	Lactating.

red in captures made over the entire period of the reproductive season of these species. Attainment of sexual maturity of young shrews occurs immediately they have left the nest. In June and July they may mate literally within a few days of starting independent life in the open. The capture in traps of pregnant females both of *S. araneus* and *S. minutus*, coincides in time with the appearance of the first young among animals caught. Thus, for instance, the earliest that a young, pregnant female *S. araneus* was captured on June 5th, 1957. In 1954, the series of the first young specimens of *S. minutus* included pregnant females.

The greatest intensity of captures of young and pregnant females occurs in June or the first half of July. With *S. araneus* it is chiefly in the first half of June, with *S. minutus* in the second half of this month, and the first half of July. This is connected, as is well known, with the later on an average about two weeks) appearance of the young of this species (Borowski & Dehnel, 1952).

From the intensification of captures of young pregnant females in June and the first half of July it appears that the first (and certainly only the first) litter in both the above species is affected by sexual maturation. This is especially convincingly visible in the case of *S. minutus*, where about 70% of all sexually active young females are caught in this very period.

The first litter of shrews would appear somewhat longdrawn-out, since in sporadic cases young pregnant females are still caught in the first days of August. For instance, a female of *S. minutus* (collect. no. 5717) was caught on August 1st and was found to be in the final phase of pregnancy, and must therefore have mated about July 10th.

On the other hand, the possibility must surely not be completely ruled out that this is a female from the second litter. It is possible that in very sporadic cases certain females from a very early 2nd litter may also attain sexual maturity.

A female *S. araneus* (collect. no. 5911) caught on August 8th, was probably pregnant for the second time, after having nursed its first litter, as was indicated by its age (2—3 months of life in the open). It is a fact that at least certain of the young females which have entered the phase of sexual activity, are capable over the period of the reproductive season, of giving birth to more than

one early-summer litter, and therefore their behaviour is the same as that of old females in the second calendar year of their lives. After giving birth, the next mating takes place at once, as in the case of old adults (i. e. animals which have lived through the winter), (Tarkowski, 1957). Evidence of this is provided by the specimens of *S. araneus* (collect. no. 16977) and *S. minutus* (collect. no. 17024) which are lactating and at the same time once again pregnant.

The last relatively young female is *S. araneus* (collect. no. 6436) captured on August 31st, 1954. Judging by the state of the milk glands this female was probably in the final phase of lactation, and must therefore have mated after July 15th. This female would therefore be the latest of its species to mature, and to a certain extent constitutes an exceptional case.

That sexual maturation of young female shrews, comes as a rule exclusively from the first litter, is indicated by an analysis of age based on the degree of wear of the teeth, and also the size of the thymus. This organ in young shrews undergoes involution, which is to a great extent correlated with the age of the animals, and within defined limits may even be its index.

Analysis of the teeth reveals that the sexually active young females of *S. araneus* and *S. minutus*, caught in traps in August, September and even in October, were born in May or at the latest in June (only exceptionally in the second half of this month, as for instance, coll. no. 6436). The majority of these females are in various phases of lactation.

2. The fecundity of young shrews is on the whole great. In both species the average size of the litters over the entire period of their reproductive season (practically speaking in June and July) is 6 embryos. It is true that these data are based on a not very large number of litters (6 litters of *S. araneus* and 9 of *S. minutus*) but they exhibit a considerable degree of agreement with the figures given for old adults in this same period (Borowski & Dehnel, 1952; Tarkowski, 1957).

3. Young, sexually active shrews are not subject to the „jumps” in growth and weight such as are observed in the spring in the case of sexually maturing old adults. Dimensions (especially length) and body weight remain within the limits of variation normal for young, sexually inactive specimens.

Attention to this has been drawn by Borowski & Dehnel (1952) and by Stein (1952).

In the spring, over a very short period of 2—3 weeks, the body weight of old adult shrews increases by about 50% in relation to the young specimens from June, July and August. Of course not only the body weight as a whole increases, but also the weight of the various internal organs. (Dehnel et al., in preparation). This is not therefore a „jump” brought about by the general condition of the animals.

In the earlier works carried out by our group, an attempt was made to connect the phenomenon of the spring „jump” in weight of the shrews primarily with the process of sexual maturation, which takes place at this same time. From the observations detailed above on the sexual maturation of young shrews it is, however, evident that we have here a case of time coincidence, and not a functional interdependence of two different processes.

Although there are young individuals in my material with relatively great body weights (Nos. 7 & 8, Table 10), they do not, however, refute the view expressed above. These are females in the final stage of pregnancy, with very large embryos, or nursing individuals with intensively developed and abundantly filled milk glands, which may cause an increase in body weight of 50%. On the other hand the milk gland may increase its weight as the result of a large amount of milk collecting, and not being drawn off, since the animal was caught in the trap.

The possibility of establishing the dependence of the spring increase in the body weight of old adult shrews on the processes of sexual maturation may therefore be ruled out. The problem still remains unsolved, and its causes should be sought for in the hormonal economy of shrews in the pre-spring period.

4. Size of thymus. As is already known, the thymus in shrews undergoes complete involution in the second half of summer and in the autumn. This process becomes evident in July, and lasts until November. Thus for several months before attaining sexual maturity, the thymus of shrews takes on a residual form (Bazan, 1952). As shown by Bazan (1955) in the case of the European water-shrew (*Neomys fodiens* Pennant) reproducing in the first calendar year of their life, similarly in the case of sexually active shrews the thymus does not undergo involution. No hastening of this process is observed even as the result of pregnancy and nursing.

The gland behaves completely normally, its size varying within the limits peculiar to young sexually inactive shrews from the same period. This is one more confirmation of the recently accepted views on the lack of direct connection between this gland and the gonads, and also the processes of sexual maturation.

* * *

Changes in the dimensions of the female sexual system of young shrews, and also the occurrence of sexual maturation in specimens from the first spring litter only, induced me to examine the occurrence and scope of this phenomenon in the various years. I was concerned here both with the percentage of sexually mature shrews in relation to all young females caught in the area, and also with the division of young females into the various classes of size of sexual organs.

Table 11.

Size of Graafian follicles depending on state of uterus and vagina in *S. araneus* L. (1954—1955).

Class of size of sexual organs	Graafian follicles			Corpora lutea	Total
	immature < 160 μ	growing 161 - 300 μ	mature > 300 μ		
I	22 64.7 %	12 35.3 %	— —	— —	34 100.0 %
II	14 35.9 %	23 59.0 %	2 5.1 %	— —	39 100.0 %
III	— —	8 32.0 %	13 52.0 %	4 16.0 %	25 100.0 %

The practical suitability of the method used at Białowieża, i. e. the visual assessment of the size of the female sexual apparatus, was also checked histologically. Table 11 shows the dimensions and degree of maturity of the Graafian follicles. In class I (uterus thin and small) about 80% is made up of specimens with immature follicles, diameter below 160 μ , and specimens in the first stage of slight growth (160—200 μ). The remaining 20% were specimens in which the Graafian follicles were considerably advanced in development.

Class II (uterus medium, and vagina slightly enlarged) is a transitional group. One-third of the specimens have immature follicles, about 60% — follicles in the growth phase. Several percent of shrews in this class possess follicles ready for ovulation.

Specimens of a more decided character of the ovaries are found in class III (sexual organs considerably enlarged). Here 80% of the specimens are females in which the Graafian follicles are in the final period of growth (200—300 μ), or are completely mature (over 300 μ in diameter). These latter were found in 52% of the cases. Further growth of Graafian follicles takes place in the common shrew after copulation (B r a m b e l l, 1935). In class III there is also a considerable percentage of pregnant females (pre-implantation stages macroscopically imperceptible).

Table 12.

Percentage of young females of *S. araneus* and *S. minutus* in the various classes of size of sexual apparatus (uterus and vagina) in 1954—1958.

Class Year	I		II		III		Young ad.		Total	
	n	%	n	%	n	%	n	%	n	%
<i>Sorex araneus araneus</i> L.										
1954	425	67.36	168	26.62	29	4.60	9	1.43	631	100.0
1955	606	84.05	105	14.56	8	1.11	2	0.28	721	100.0
1956	84	85.71	9	9.18	3	3.06	2	2.04	98	100.0
1957	136	90.67	13	8.67	-	-	1	0.67	150	100.0
1958	99	91.67	7	6.48	1	0.93	1	0.93	108	100.0
<i>Sorex minutus minutus</i> L.										
1954	50	64.10	14	17.95	6	7.69	8	10.26	78	100.0
1955	84	86.60	3	3.09	6	6.19	4	4.12	97	100.0
1956	43	89.58	2	4.17	-	-	3	6.25	48	100.0
1957	53	94.64	3	5.36	-	-	-	-	56	100.0
1958	19	82.61	2	8.70	2	8.70	-	-	23	100.0
<i>Sorex caecutiens karpíński</i> Dehnel										
1954	32	84.21	4	10.53	1	2.63	1	2.63	38	100.0
1955	19	73.08	5	19.23	2	7.69	-	-	26	100.0

From the above it will be seen that only class I and III are clearly differentiated. There are therefore no justifiable grounds for distinguishing henceforth three classes of size of the sexual apparatus in young shrews, but only two. The first class would embrace specimens devoid of, or with only very inconsiderable progressive changes in the sexual apparatus (present classes I and majority specimens from class II), while in the second class would be included all specimens exhibiting a decided progression in dimensions of the uterus and vagina (present class III and part of II).

Table 12 shows the distribution of all three species of shrew examined, according to the class of size of the female sexual apparatus.

The percentage of sexually maturing shrews in the various years investigated is not uniform, but subject to very significant changes. Intensification of sexual maturation was observed in 1954 and 1956, and as stated earlier, also in 1949. In the case of *S. araneus*, in the remaining years only a very small percentage of young females matured (0.28—0.93%). With *S. minutus* the material is scanty from these years, so that on the strength of statistical probability only there might not be grounds for expecting to capture sexually active specimens. It is worthy of note that in the years of intensification of sexual maturation, the percentage of young females of *S. araneus* and *S. minutus* in the third class of size of sexual apparatus is considerably larger.

Table 13.

Seasonal changes in percentage of young ♀♀ *S. araneus* L. in classes of size of sexual apparatus.

Class Month	I		II		III		Young ad.		Total	
	n	%	n	%	n	%	n	%	n	%
1954										
VI	53	60.92	21	24.14	10	11.49	3	3.45	87	100.0
VII	168	60.00	99	35.36	12	4.28	1	0.36	280	100.0
VIII	142	73.20	41	21.13	7	3.61	4	2.06	194	100.0
IX	49	89.09	5	9.09	-	-	1	1.82	55	100.0
X	14	93.33	1	6.67	-	-	-	-	15	100.0
1955										
VI	81	74.31	23	21.10	4	3.67	1	0.92	109	100.0
VII	262	84.24	46	24.79	3	0.96	-	-	311	100.0
VIII	108	83.08	20	15.38	1	0.77	1	0.77	130	100.0
IX	128	88.89	16	11.11	-	-	-	-	144	100.0
X	27	100.00	-	-	-	-	-	-	27	100.0

The table referred to above, also reveals a very significant difference in the extent of the phenomenon of sexual maturation in females of *S. araneus* and *S. minutus*. In the latter species sexual maturity is attained by a far greater percentage of young females (4 to 10%), whereas with *S. araneus* this process affects a maximum of 2% of all young females.

With all three species of shrew examined, sexual maturation in the first calendar year of life is apparent in the same years. Certain observations would seem to indicate that changes in the extent of

the phenomenon of attainment of sexual maturity by young shrews in the various years are connected with the food supply of these animals, and also with the meteorological conditions prevailing at the given period (temperature, insolation, precipitation).

Table 14.

Ratio of sexually active young females (young adult) to old adult females in captures over years 1954–1958.

Years	Age class	Months					Total		
		III-V	VI	VII	VIII	IX	n	%	
		old ad.	young ad.						
<i>Sorex araneus araneus</i> L.									
1954	young adult	-	3	1	4	1	9		6.29
	old adult	47	11	18	21	37	134	93.71	
1955	young adult	-	1	-	1	-	2		1.09
	old adult	32	16	26	52	55	181	98.91	
1956	young adult	-	-	1	1	-	2		3.12
	old adult	49	3	2	4	4	62	96.88	
1957	young adult	-	1	-	-	-	1		2.86
	old adult	15	5	1	5	8	35	97.14	
1958	young adult	-	1	-	-	-	1		7.69
	old adult	7	2	-	2	1	12	92.31	
<i>Sorex minutus minutus</i> L.									
1954	young adult	-	5	1	1	-	7		21.88
	old adult	7	2	3	5	8	25	78.12	
1955	young adult	-	3	-	1	-	4		10.00
	old adult	5	4	9	17	1	36	90.00	
1956	young adult	-	-	3	-	-	3		15.79
	old adult	12	2	-	1	1	16	84.21	
1957	young adult	-	-	-	-	-	-		-
	old adult	7	2	-	2	-	11	100.00	
1958	young adult	-	-	-	-	-	-		-
	old adult	4	-	1	1	1	7	100.00	

The data given above were calculated from material obtained by trapping. I have previously emphasised (Pucek, 1959) the influence exerted by the trapping method used, the activity of the animals and similar factors, on the qualitative and quantitative result of the collection. There is no doubt that the activity of the pregnant, and especially of the nursing female shrews, differs from that of sexually immature individuals. This of course brings about a basic deviation from the actual relations prevalent in the area, and leads in this case to a diminution of the percentage of sexually active females in the material captured.

As the sexual maturation of young shrews takes place during the first few days of their active life in the open (i. e. during the period when the first spring litter becomes self-sufficient), the figures of greatest significance for an assessment of the extent of this process will those obtained from the June, and possibly the July material. In the following months of the life cycle of the shrew no developmental tendencies in the dimensions of the sexual organs are apparent. This can be seen from the tables referred to above of the measurements of uterus and vagina, and also from table 13, included here as an example, from which it is clear that as from July the percentage of individuals in the III and II classes of size the sexual organs distinctly decreases. From the beginning of August onwards, no young females with greatly enlarged uterus and vagina are found in the populations of *S. araneus* and *S. minutus*.

The question therefore arises as to what is the participation of sexually mature young shrews in the multiplication of the species. Relevant data have been collected in table 4 illustrating the ratio of sexually active young females to the total number of females of *S. araneus* and *S. minutus* captured. The percentages are very similar, since, as is already known, not all old adult females are sexually active, especially at the end of the reproductive season (Borowski & Dehnel, 1952; Dunajeva, 1955; Tarkowski, 1957).

Table 14 shows that with *S. araneus*, young sexually active females may constitute in the various years from 1 to 7% of all reproducing females of this species. With *S. minutus* the corresponding data fluctuate within the limits of 10—22%.

From the above it would seem necessary to conclude that at least in certain years, the phenomenon of sexual maturation of young females of *S. araneus*, and in particular of *S. minutus*, may exercise a significant influence on fertility, and in consequence, on the population dynamics of these species.

V. VARIATION IN SIZE OF TESTES OF YOUNG MALES

An indication of the sexual maturation of males is undoubtedly the size of the testes, and also the development of the remaining parts of the male sexual apparatus. My observations are based on one feature, i. e. the size of the cross-section of the testis, calculated according to formule $ab\pi$.

The variation in size of testes of *S. araneus* in the years 1954 and 1955 is shown in table 15, and as can be seen from this there are distinct seasonal differences. The young males from first litter (June) have the largest testes after leaving the nest. In the next period from July to October a gradual regression of the gonads can be observed. Young males born in summer and autumn litters do not attain the size of testes observed in young animals caught in June.

In addition to the diminution of the monthly arithmetical averages of testis size, a distinct decrease in the variance (σ^2) of index $ab\pi$ is noted. Characteristic differences in the distribution of quantities in the various classes are more clearly distinguishable in 1955 than in 1954. Differences between successive years are thus apparent here.

Table 16.
Variation in size of testes ($ab\pi$) in young males of *S. minutus*
in 1954 and 1955.

mm ² Months	0.5-	1.0-	1.5-	2.0-	2.5-	3.0-	n	Av.
	1 9 5 4							
VI	—	2	1	4	1	1	9	2.134
VII	2	5	3	2	—	—	12	1.453
VIII	8	15	2	—	—	—	25	1.125
IX	7	13	1	—	—	—	21	1.102
X	1	3	—	—	—	—	4	1.120
VI-X	18	38	7	6	1	1	71	1.301
1 9 5 5								
VI	—	2	6	—	—	—	8	1.620
VII	1	12	3	1	—	—	17	1.362
VIII	5	13	4	1	—	—	23	1.267
IX	6	13	1	—	—	—	20	1.120
VI-IX	12	40	14	2	—	—	68	1.289

In general distribution of variation in size of the testes of *S. araneus* a distinct shift of the average in the direction of greater values is observed. This distribution is also evident in the dividing columns for the various months especially from June to August. It has been established mathematically that the deviations from

the line of regression are too great to permit of its being a straight line, and it will therefore be a parabola.

The variation in testis size has a similar character in the case of *S. minutus* (Table 16).

From both tables it appears that in June the progressive tendency in the development of the testes is very evident (although not uniformly in every year). This is apparent both in the averages, very wide divisions of variation and the large values of σ^2 , and also in the presence of a certain percentage of individuals with especially large testes. The latter were particularly noted in 1955 in both *S. araneus* and *S. minutus*.

Table 17.

Comparison of young males with enlarged testes of *S. araneus* L.

No. coll. & age class	Date of capture	Body length in mm.	Weight in grm.	Dimensions of testes in mm.	a · b · π	Max. diam. of seminal canal in μ	Remarks
4621 I ₁	12.VI.54	62	7.40	3.4 x 2.2	5.87	77.6	Semen absent
9119 I ₂	18.VI.55	68	6.30	3.4 x 2.6	6.94	103.5	— " —
8586 I ₁	7.VI.55	63	6.00	4.6 x 2.7	9.34	112.3	— " —

As the result of a detailed analysis of conspicuously enlarged testes of three males of *S. araneus* in June 1954 and 1955, it was found that despite the distinct tendency to growth, production of semen did not take place (Table 17). The remaining parts of the sexual system were very little advanced in development, and then only in the two last specimens in table 17.

From the material presented above it would appear that sexual maturation of young male shrews in the first calendar year of their life is theoretically possible, but that this has not so far been observed under natural conditions.

VI. SUMMARY AND CONCLUSIONS

5076 shrews (*Sorex araneus* L., *Sorex minutus* L., and *Sorex caecutiens* Laxmann) caught in the Białowieża National Park between 1949 and 1958 were subjected to a detailed morphological analysis. Thirty-four sexually active young female shrews were found in this series.

With young shrews from first litter, the largest dimensions of the female sexual organs (length and thickness of vagina, length of uterine horns, size of ovary) are observed in June and July. A considerable percentage of the specimens are subject to developmental processes, which influence the increase during this period of the variances in the dimensions referred above. It would seem that there is a connection between the fluctuations in dimensions of the sexual system of young females, and the occurrence and intensification of sexual maturation in the various years.

Sexually active young shrews are encountered throughout the whole reproductive season of these animals. Sexual maturity is however attained only by the young females from the first spring litter (analysis of age according to degree of wear of the teeth).

The fecundity of young females is the same as that of old adults (animals which have lived through the winter) in the corresponding period. At least some among the sexually mature young females are capable of producing more than one litter.

Young, sexually active female shrews are not subject to the rapid increase in length and body weight which are so characteristic of the old adults during the period of their sexual maturation. It would seem that both these processes (maturation and „jump” in growth) coincide only as to time. The sexual activity of old adults is capable only to an inconsiderable extent of influencing the increase in dimensions and body weight (attainment of virility by the males, growth of the gonads, development of the embryos and milk glands), and does not explain the whole of the phenomena which are connected with the spring „jump” in growth.

Pregnancy and nursing do not cause acceleration of the involution of the thymus in young shrews. This organ maintains the dimensions normal for young sexually inactive animals.

Intensity of sexual maturation in young females varies in the different species and in different years. With *S. araneus*, the percentage of sexually active young females fluctuates within limits of 0.28 to 2.04, whereas with *S. minutus* the limits are from 4.12 to 10.26, in relation to all the females in this age group (young).

The young females of *S. araneus* constitute in the various years from 1 to 7.7% of all reproducing females (juv. + ad.). The corresponding percentage of young females of *S. minutus* varies from 10 to 22. The sexual maturation of young females of *S. araneus*, and particularly of *S. minutus* in certain years may therefore

exert a significant influence on the population dynamics of these species.

In June a distinct developmental tendency is observed in the dimensions of the testes of young males of *S. araneus* and *S. minutus*. In certain years this tendency may embrace a considerable percentage of males. No sexually active young males have so far been observed in natural conditions, although this would seem to be theoretically possible.

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STRESZCZENIE

Możliwie wszechstronnej analizie biomorfologicznej poddano 5076 ryjówek (*Sorex araneus* L., *Sorex minutus* L. i *Sorex caecutiens* Laxmann), łowionych na terenie Białowieskiego Parku Narodowego w latach 1949—1953 (Tabela 1). W serii tej znaleziono 34 aktywne płciowo młode samice (Tabela 10).

Największe wymiary żeńskiego aparatu płciowego (długość i grubość pochwy, długość rogów macicy, wielkość jajnika) obserwuje się u młodych ryjówek z pierwszego miotu w czerwcu (Tabele 3—9). Procesom rozwojowym podlega znaczny procent okazów, co wpływa na zwiększenie się w tym okresie średnich i wariacji wymienionych wymiarów. Zjawiska te mogą prowadzić do osiągnięcia dojrzałości płciowej u pewnego procentu młodych samic. Wydaje się, że przemawia za tym związek, istniejący między wahaniami wymiarów aparatu płciowego młodych samic a występowaniem i natężeniem dojrzewania płciowego w poszczególnych latach.

Aktywne płciowo młode ryjówek spotykane są w ciągu całego sezonu rozrodczego tych zwierząt. Dojrzałość płciową osiągają jednak młode samice z pierwszego, wiosennego miotu (analiza wieku).

Płodność młodych samic jest taka sama jak przezimków w odpowiednim okresie. Przynajmniej niektóre samice, spośród dojrzałych płciowo młodych okazów mogą mieć więcej niż jeden miot.

Aktywne płciowo młode samice nie podlegają skokowi wzrostowemu i wagowemu, tak charakterystycznemu dla przezimków w czasie ich dojrzewania płciowego. Wydaje się, że oba te procesy (dojrzewanie i skok wzrostowy) są tylko w zbieżności czasowej. Dojrzałość płciowa przezimków może wpływać tylko w niewielkim stopniu na zwiększenie wymiarów i wagi ciała (mężnienie samców, wzrost gonad, rozwój płodów i gruczołów mlecznych) i nie tłumaczy całokształtu zjawisk, związanych z wiosennym skokiem wzrostowym.

Ciężarność i karmienie nie powodują przyspieszenia inwolucji grasicy u młodych ryjówek. W warunkach naturalnych (podobnie zresztą jak i laboratoryjnych) narząd ten zachowuje wymiary właściwe dla zwierząt młodych, płciowo nieaktywnych.

Natężenie dojrzewania płciowego młodych samic jest różne u obu gatunków (*S. araneus* i *S. minutus*) i zmienne w poszczególnych latach. U *S. araneus* procent aktywnych płciowo młodych samic waha się w granicach od

0,28 do 2,04, zaś u *S. minutus* od 4,12 do 10,26, w stosunku do wszystkich samic tej grupy wiekowej (Tabela 12). Młode samice *S. araneus* stanowią w poszczególnych latach od 1,0 do 7,7 procent wszystkich rozmnażających się samic (juv. + ad.). Odpowiednio procent młodych samic *S. minutus* — waha się od 10,0 do 22,0 (Tabela 14). Dojrzewanie płciowe młodych samic *S. araneus* a szczególnie *S. minutus* może zatem wywierać w niektórych latach istotny wpływ na dynamikę populacji tych gatunków.

W czerwcu, u osobników z pierwszego miotu, obserwuje się wyraźną tendencję rozwojową w wymiarach jąder młodych samców *S. araneus* (Tabela 15) i *S. minutus* (Tabela 16). W niektórych latach znaczny procent samców może mieć jądra wyraźnie powiększone. Dotychczas nie zaobserwowano jednak w warunkach naturalnych, aktywnych płciowo młodych samców, aczkolwiek w oparciu o zmienność jąder wydaje się to teoretycznie możliwe.

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