Irena BAZAN - KUBIK

VARIATIONS IN THE THYMUS GLAND OF THE HARVEST MOUSE, *MICROMYS MINUTUS* (PALLAS 1771)

ZMIENNOŚĆ GRASICY BADYLARKI *MICROMYS MINUTUS* (PALLAS 1771)

The material used in this work consisted of 86 specimens caught in the Białowieża National Park in 1949, 1950 and 1952, 80% of which were caught in 1949. The technique employed in their conservation, the determination of their age and weighing is described in the papers by Kubik (1952) and Bazan (1952).

The material analysed consists mainly of young specimens caught at Białowieża, beginning with the second half of May. These animals attain sexual maturity early in the summer (Kubik, 1952). During the summer and autumn, up to December, harvest mice from later litters, which do not in general mature at all, are caught. Of the animals examined I have only a few older or old individuals, which is understandable in view of the fact that by the late summer and autumn the population of mice born the previous calendar year are dying out.

The thymus gland of the harvest mouse is situated pectorally. The lobes are as a rule separated from each other, often divided by a fairly thick layer of adipose tissue. The thymus gland never covers more than 1/3 of the area of the heart. With the decrease in the weight of the gland, changes in the thickness of the lobes are first observed, followed by a decrease in their area and liquidation of the thinner parts of the lobes. With young animals during the winter period, as in the case of older harvest mice, the thymus gland presents two very small separated lobes, surrounded by a large amount of adipose tissue. They are often firmly attached to the sternum. The reduction of the thymus in the hedgehog (Peter, 1935) and the birchmouse (Bazan-Kubik, 1958) follows a similar course.

A phenomenon characteristic of the thymus gland of the harvest mouse, and also observed in other small mammals, is the great individual variation in its weight in different months (in animals of the same age). This is caused by the well-known sensitiveness of the thymus gland to variations in the living conditions of the animal. Variation in the weight of thymus glands in animals examined lay between the limits of 10.1 to 0,5 mg. (only in two harvest mice did the thymus gland weigh less than 1 mg.).

The harvest mice examined were divided into three classes: class I — thymus glands over 5 mg. in weight — „heavy"; class II — from 4.9 to 2.0 mg. — „average"; class III — less than 1.9 mg. — „light".

In connection with the specific course taken by captures, the following interesting arrangement of average weights of the thymus gland can be observed, as shown in the following table:

Month	VIII	IX	X	XI	XII
Avg. weight in mg.	3.6	4.4	4.0	3.8	2.3

The greatest average weights of the thymus gland are encountered in September and October, which is connected with the considerable increase

in the number of very young, sexually immature, individuals captured during these months. The average weight of the thymus gland decreases markedly in December (there is no influx of young individuals in this month).

The weight of thymus glands in harvest mice caught during the winter period is small. These are „light" glands (class III). As the animal grows old the weight of the thymus gland decreases and probably towards the end of the harvest mouse's life this gland becomes merely a relic.

The greatest number of „heavy" thymus glands belonging to class I can be observed in September and October. Their number decreases markedly in November, and there are no glands belonging to this age class by December. Generally speaking, the majority of the thymus glands fall within the „average" category (class II). Their number increases with the beginning of October. „Light" thymus glands (class III) occur in all months, their numbers varying. There is a considerable percentage of these glands in August, belonging to sexually mature and nursing individuals born in the first litters. The greatest percentage of „light" thymus glands falls in December, and belongs to older animals. This is, of course, also connected with the time of the year.

In general from November onwards a marked tendency is found to a progressive process of reduction of the thymus gland. The data in the following table illustrate this:

Age class	VIII	IX	X	XI	XII
I	25.0%	40.9%	34.6%	16.2%	—
II	41.7%	40.9%	46.2%	67.6%	50.0%
III	33.3%	18.2%	19.2%	16.2%	50.0%

Histological analysis of the thymus glands of harvest mice indicate the existence of seasonal and age involution of this organ. It is possible histologically to show the difference in structure between the glands of animals caught in the summer and autumn periods, and that of the winter thymus gland.

During the summer-autumn period the thymus gland of the harvest mouse has a lobular structure. It is the cortex which primarily undergoes division into lobules. Numerous connective tissue septa are visible. The medulla is common to the whole lobe. The peripheral part is fairly narrow, but distinctly differentiated from the medulla. A very marked densification of lymphocytes can be observed in the cortex. Numerous large groupings of cells are visible in the medulla. The blood vessels are fairly numerous, usually filled with blood, Hassal's corpuscles are large and occur in relatively great numbers. There is usually a large amount of adipose tissue between and round the lobes.

The difference between the cortex and medulla is obliterated in the thymus glands of harvest mice caught in the winter. A smaller number of cells can be observed. Aggregations in the form of „fields" are formed in the medulla. Between these „fields" parts of the medulla can be observed which have a very small amount of lymphocytes and a contracting epithelial reticulum. These parts give a picture of the regression of the thymus gland. I observed a similar structure in the thymus gland in the

European water shrew (Bazan, 1955). Blood vessels are very few, and there is almost complete absence of Hassal's corpuscles. Peter (1935) in investigating the winter thymus gland of the hedgehog found almost complete atrophy of Hassal's corpuscles, while Coninx-Girardet (1927) also observed a considerable decrease in the amount of these corpuscles in the thymus gland of the marmot during the winter. The lack of histological material unfortunately makes it impossible to trace the structure of the thymus gland during the period of its regeneration.

Histological pictures of the seasonal variations in the thymus gland of the harvest mouse are reminiscent of the relations described by Schaffer & Rabl (1909), in the case of the thymus gland of the mole, and by the same authors and also by Peter (1935) of the hedgehog. They found that the thymus gland of the mole and hedgehog, irrespective of age, passes through the period of its greatest development during the summer and autumn, and undergoes reduction in the winter (in the case of the hedgehog to as much as $^1/_{30}$ of its size in the summer). These authors also draw attention to the lack of differentiation between the cortex and medulla during the winter. The involution of the thymus gland follows a similiar course in the birchmouse. This phenomenon is known to occur not only in the case of small mammals — for instance, Browman & Sears (1956) when examining the thymus gland of the mule deer found that it also undergoes involution during the winter period, and regeneration in the spring.

Pregnant and nursing female harvest mice exhibit smaller weights of the thymus gland. I observed similar behaviour of this gland in pregnant and nursing individuals of *Neomys fodiens* (Pennant 1771) and *Sicista betulina* (Pallas 1773) — Bazan-Kubik, 1955; 1958. In all the above cases there is no question of any hormonal connection between the gonads and the thymus gland.

I did not find any correlation between body weight and weight of the thymus gland in either the harvest mouse, or in other small mammals.

REFERENCES

Bazan, I. — Zmiany morfohistologiczne grasicy u *Sorex araneus* L. w cyklu życiowym. Ann. Univ. M. Curie-Skłodowska, Sect. C, 7: 253—304. Lublin, 1952. Bazan, I. — Untersuchungen über die Veränderlichkeit des Geschlechtsapparates und des Thymus der Wasserspitzmaus (*Neomys fodiens fodiens* Schreb.). Ib. 9: 213—259. 1955. Bazan-Kubik, I. — Untersuchungen über die Thymusdrüse der Birkenmaus (*Sicista betulina* Pallas). Acta Theriol., 2: 83—106, Białowieża, 1958. Browman, L. C. & Sears, H. S. — Cyclic variation in the mule deer thymus. Proc. Soc. Exp. Biol. Med., 93: 1. 1956. Coninx-Girardet, B. — Beiträge zur Kenntnis innensekretorischer Organe des Murmeltieres (*Arctomys marmota* L.) und ihrer Beziehungen zum Problem des Winterschlafes. Acta Zool., 8: 161—224. 1927. Kubik, J. — *Micromys minutus* Pall. w Białowieskim Parku Narodowym. Ann. Univ. M. Curie-Skłodowska, Sect. C, 7: 449—495. Lublin, 1952. Peter, H. — Das histologische Bild des Igelthymus im jahreszeitlichen Zyklus. Zt. Anat. Entw., 104: 294—326. Berlin, 1935. Schaffer, J. & Rabl, H. — Das thyreothymische System des Maulwurfs und Spitzmaus. Sitzgber. Akad. Wiss. Wien, Abt. III, 117: 289—294, 551—659; 118: 217—263, 549—628. Wien, 1909.

Mammals Research Institute in Białowieża, Polish Academy of Sciences.