

# Morphological Characteristics of the Thymus in Acute Poisoning With Ento Defol

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**Abstract:** The article presents morphological changes developing in the thymus stroma during poisoning with Ento Defol. Specifically, a single high dose of the defoliant (1/10 LD50) resulted in a reactive thickening of collagen fibers in the interlobular barriers of the thymus and perivascular zones. These changes were assessed as a compensatory response developing against the background of interstitial edema and microcirculatory disturbances. A sharp increase in the number of mast cells in the perivascular and subcapsular zones, along with clear signs of degranulation, was also detected. Increased metachromasia indicated the activation of reactive inflammatory processes associated with the release of biologically active substances.

**Key words:** thymus gland, rat, defoliant, Ento Defol, acute poisoning, morphological changes.

**Introduction.** The thymus is a central organ of the immune system, providing protection from external influences, which is ensured, among other things, by the presence of a blood-thymic barrier, similar to the blood-brain barrier. However, many researchers have shown that antigens can penetrate the thymus itself after intraperitoneal or intravenous administration. The blood-thymic barrier has become a relatively common concept. Furthermore, there is an alternative pathway for antigens to enter the thymus—directly from the parathymic lymph nodes through the capsule (Kvaratskhelia A.G. et al., 2016; Rovda Yu.I. et al., 2020) [3,5].

The thymus is responsible for the formation and maintenance of the body's biological defenses (Abaeva T.S., 2017) [1]. Specialists in the field of immunomorphology define the immune system as a set of organs, tissues, and cells whose function is to protect the body from various diseases and eliminate foreign substances that have already entered the body (Perez Y.E., Moran C.A., 2022; Wang H., Zúñiga-Pflücker J.C., 2022) [13,15].

The immune system prevents infections (bacterial, viral, fungal). When the immune system is not functioning properly, the likelihood of developing infections increases, which also leads to the development of autoimmune diseases (Rozhkova I.S., Teply D.L., 2016) [6].

By now, the negative impact of many pesticides on the body has been proven, leading to the development of pathological conditions (Zaydullaeva M.O., 2018; Khamidulina G.Kh., Rabikova D.N., 2020) [2,10]. In agriculture, along with various pesticides, new ones are used, for example, the defoliant and dexcitant Ento Defol. The effect of pesticides on the digestive system, kidneys, circulatory organs and the immune system has been studied. There are studies of changes in bone marrow, bone tissue regeneration and testicles under the influence of various defoliants (Sagatov T.A. et al., 2019; Tursunmetov I.R., 2023; Umarova Z.Kh., 2024; Verma R.S., Srivastava, A.K., 2017) [7,8,9,14].

The literature lacks comprehensive information on the state of adaptive responses in the thymus after exposure to pesticides, including Ento Defol. This underscores the need for a detailed study of morphofunctional changes in the gland after a single exposure to various doses of pesticides, which is crucial in terms of its significance (Mukhamedzhanov A.Kh., 2024; Khasanova D., 2021; Maletin N. et al., 2025) [4, 11, 12].

**Objective of the study.** To study morphological changes in the rat thymus after a single acute administration of Ento Defol.

**Materials and methods.** The experimental study was conducted on adult male rats weighing 150–200 g. The pesticide was dissolved in distilled water. Accordingly, a dose of 1/10 the LD<sub>50</sub> was selected. A standard syringe with a metal probe was inserted deep into the rat's mouth, and the drug was slowly injected.

The LD<sub>50</sub> (median lethal dose) of the pesticide was selected based on the data specified in the "Safety and Environmental Protection Requirements" data sheet for the use of pesticides (2022). For rats, it is 3520 mg/kg body weight. The threshold dose corresponds to a pesticide dose equal to 1/100 of the LD<sub>50</sub> for rats; this dose is often encountered by humans and mammals in areas of intensive pesticide use, making its use of this dose of pesticide of practical importance. Such doses may affect people involved in pesticide production and defoliation. For this reason, the fractions chosen were 1/10 LD<sub>50</sub> (352 mg/kg) for a single exposure.

Animals were divided into groups (18 male rats in total):

1. Intact group – 6 rats.
2. Control group – 6 rats (distilled water administered once).
3. Group 1/10 LD<sub>50</sub> – 6 rats (administered a single dose, analyzed 3 hours later).

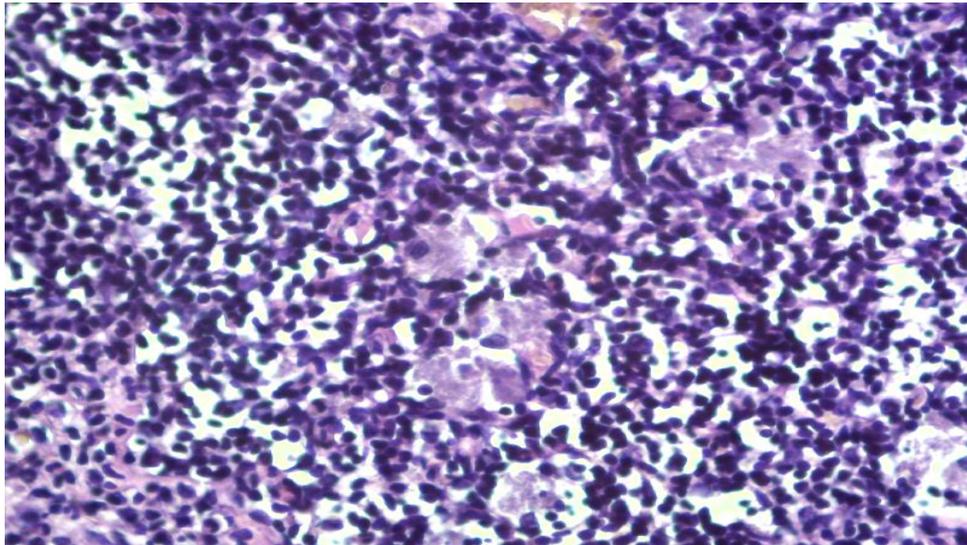
The following general histological methods were used for the study: hematoxylin and eosin staining of sections to examine the overall structure of the thymus, van Gieson staining to assess the condition of connective and muscle tissue, and toluidine blue staining.

### **Study results and discussion.**

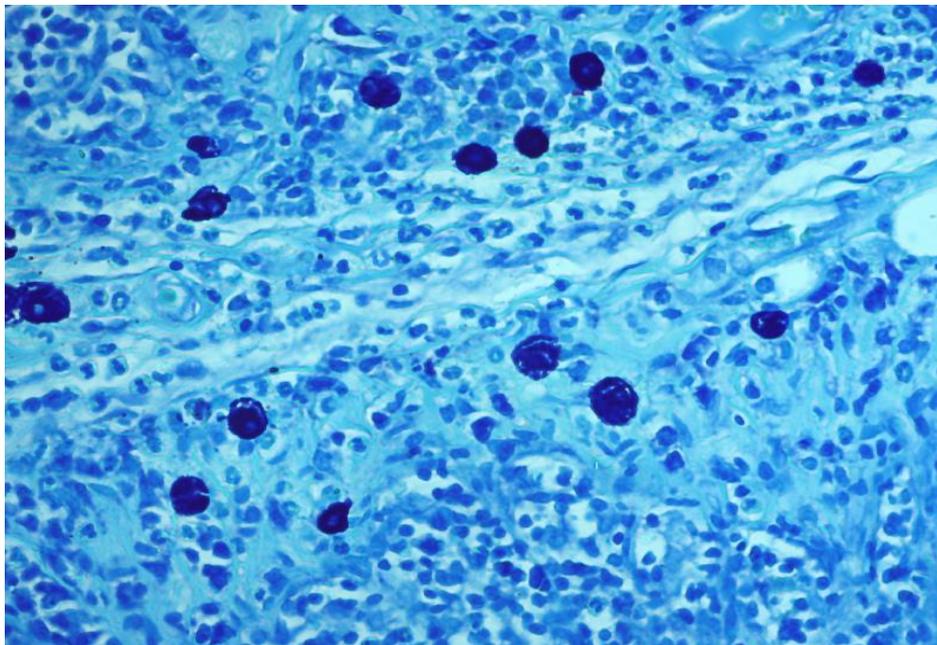
**Macroscopic changes in the thymus exposed to Ento Defol at a dose of 1/10 LD<sub>50</sub>.** Macroscopic examination reveals that the paired structure of the thymus is preserved; symmetry between the right and left lobes is somewhat disrupted; some lobes are unevenly reduced in size, while others are enlarged due to reactive edema. The organ's consistency is relatively soft, with loose areas in places, which is explained by acute circulatory disorders in the parenchymal tissue and interstitial edema. The thymus capsule is externally intact and dull in color. In places, the capsule is tense and uneven in appearance, the surface is smooth, and in some areas, there are protrusions, which is believed to be associated with reactive changes in the internal structure of the lobes. The thymus has a dark reddish or grayish-red color, indicating the development of blood stagnation (hyperemia), venous congestion, and microcirculatory disorders [3]. In some areas, small hemorrhagic foci consistent with punctate or linear hemorrhages are found on the surface of the thymus. The topographic relationship of the thymus to the surrounding tissues is preserved, and upon separation, relative looseness and hydration of the tissues are noted. In section, the thymus parenchyma has a lower density than in the intact state, increased moisture content, and an uneven granularity. The section boundaries are blurred in some areas, and the distinction between the central and peripheral parts is unclear. Blood vessels and light, loose foci characteristic of interstitial edema are visible in the section.

**Microscopic changes in the thymus exposed to Ento Defol at a dose of 1/10 LD<sub>50</sub>.** The thymus was preserved externally, surrounded by a capsule consisting of dense connective tissue; reactive changes, edema, and signs of microcirculation disorders were observed in the parenchyma under the capsule. Interstitial spaces from the capsule into the organ were preserved, and division of the parenchyma into segments was observed through them. Despite the preservation of the basic structure of thymus segments, the morphological relationship between the cortex and medulla layers significantly changed (Fig. 1). The density of thymocytes in the cortex layer decreased sharply, and a decrease in the number of lymphoid cells was clearly observed, especially in the central parts. Many thymocytes exhibited changes characteristic of pyknosis of the nucleus, karyorrhexis and karyolysis, as well as apoptosis and, in some cases, necrobiotic processes. A decrease in the number of lymphoblasts and young thymocytes indicates a decrease in proliferative activity in the thymus [15]. Cells in a state of mitosis

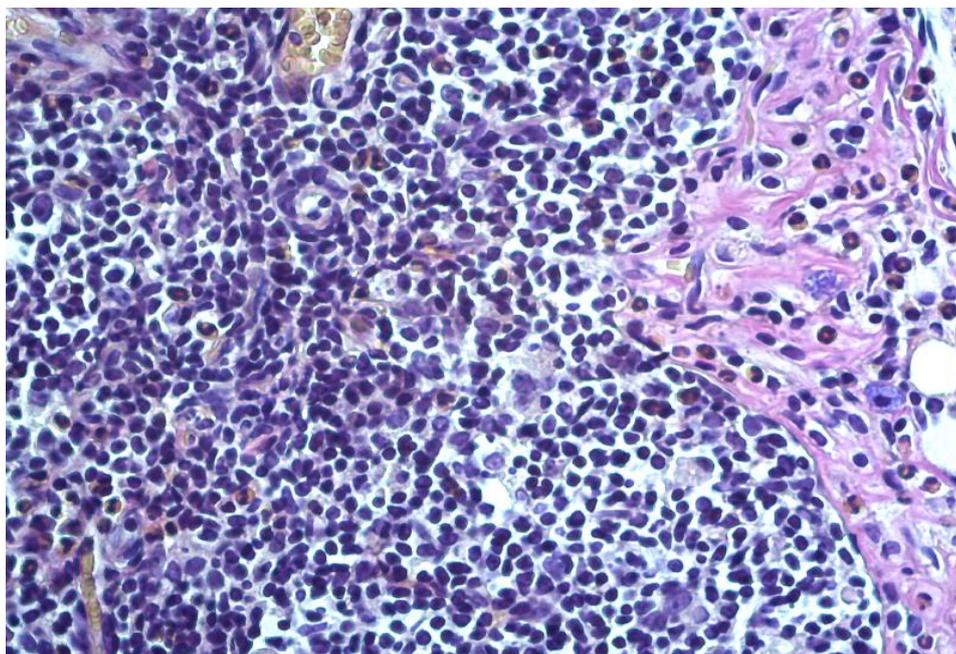
are very rare. Although the reticular structure of the epithelial reticulocytes is relatively preserved, some of them demonstrate vacuolar degeneration, cytoplasmic lightening, and changes in nuclear morphology. The overall thickness of the cortex is reduced, creating a "sparse" appearance in some areas. The boundary between the cortex and medulla is blurred compared to the intact state, and the difference in cell density is reduced. Although the number of thymocytes in the medulla is relatively preserved, their morphological state is heterogeneous; degenerative changes are detected in some cells [12]. Epithelial reticulocytes are relatively predominant in the medulla, among which thymic bodies (Hassall's corpuscles) of various sizes and shapes are observed. In some of these bodies, an increase in hyaline elements is noted. In the vascular system, venous congestion, capillary dilation, and, in some cases, signs of perivascular edema are observed. In some areas, small hemorrhagic foci form. In cases of macrophage overgrowth, interstitial edema is observed in the stromal elements (Figs. 2, 3).



**Fig. 1. Microscopic changes in the thymus under the influence of Ento Defol at a dose of 1/10 LD50. Stained with hematoxylin and eosin. (400x).**



**Fig. 2. Microscopic changes in the thymus under the influence of Ento Defol at a dose of 1/10 LD50. Stained with toluidine blue. (400x).**



**Fig. 3. Microscopic changes in the thymus under the influence of Ento Defol at a dose of 1/10 LD50. Staining – according to Van Gieson. (400x).**

**Conclusion.** Morphological results clearly demonstrated the dose- and time-dependence of reactive degenerative processes developing in the thymic stroma under the influence of the defoliant. A single high dose of Ento Defol (1/10 LD50) resulted in reactive thickening of collagen fibers in the interlobular barriers of the thymus and perivascular zones. These changes were assessed as a compensatory response developing against the background of interstitial edema and microcirculatory disorders. A sharp increase in the number of mast cells in the perivascular and subcapsular zones, along with clear signs of degranulation, was also detected. Increased metachromasia indicated the activation of reactive inflammatory processes associated with the release of biologically active substances.

#### REFERENCES:

1. Abaeva TS Features of macro- and microscopic anatomy of the thymus gland in early childhood and in the elderly // Bulletin of the Kyrgyz-Russian Slavic University. - Vol. 17. № 10. 2017. - P. 180-183.
2. Zaydullaeva M. O. Harmful effects of pesticides on human health // Economy and Society. - 2018. - № 6 (49). - P. 427-430
3. Kvaratskhelia A.G., Klochkova S.V., Nikityuk D.B., Alekseeva N.T. Morphological characteristics of the thymus and spleen under the influence of factors of various origins // Journal of Anatomy and Histopathology. – 2016. – T. 5, № 3. – P.77-83
4. Mukhamedzhanov A.Kh. Ultrastructural and morphometric features of the thymus gland in chronic toxic hepatitis // Central Asian Research Journal for Interdisciplinary Studies (CARJIS) special issue – medicine. – 2024, December. – Vol.1 – Issue 3. – P. 171-178.
5. Rovda Yu.I., Vedernikova A.V., Silantyeva I.V., Minyaylova N.N. Aspects of the thymus gland (thymus) in childhood (part I) // Mother and Child in Kuzbass. - 2020. - № 4. – P. 59-69.
6. Rozhkova I.S., Teplyy D.L. Pharmacological correction of the dynamics of free radical processes in the organs of the immune system against the background of chronic intoxication // Natural sciences. - 2016. - № 1(54). - pp. 72–77.

7. Sagatov T.A., Khozhanazarova S.Zh., Yusupova N.T., Niyozov N.K. Morphological state of the microcirculatory bed and tissue structures of the uterus in chronic intoxication with the pesticide "Vigor" // Problemy nauki. - 2019. - № 2 (38). - P. 56-60.
8. Tursunmetov I.R. The effect of pesticides administered through the mother's body on the morphogenesis of the testes of the offspring during puberty // Economy and Society. - 2023. - № 11 (114)-1. - P. 1274-1276.
9. Umarova Z.Kh. The effect of pesticides on the mother's body and their influence on the development of the spleen in her offspring // Universum: chemistry and biology: electron. scientific journal - 2024. - № 12 (126). - P. 38-40,
10. Khamidulina H.H., Rabikova D.N. Green pesticides (advantages and problems of implementation) // Toxicological Bulletin. - 2020. - № 3 (162) - P. 53-56
11. Khasanova D. Morphological features of the thymus under normal conditions and under the influence of a genetically modified product in an experiment // Society and Innovation. - 2021. № 2 (2 / S). - P. 407-411. <https://doi.org/10.47689/2181-1415-vol2-iss2/S-pp407-411>
12. Maletin N., Denda N., Borocki S., Golušin Z., Rašković A., Fejsa-Levakov A., Višnjic B.A., Amidžić J. Morphological characteristics of microenvironment in the human thymus during fetal development. //BMC Res Notes. - 2025 Mar. - 3;18(1):92. doi: 10.1186/s13104-025-07109-2.
13. Perez Y.E., Moran C.A. The thymus: General concepts on embryology, anatomy, histology and immunohistochemistry. //Semin Diagn Pathol. – 2022. - №39(2). - №86–91.
14. Verma R.S., Srivastava A.K. Triazole pesticides: A review of some recent advances. // Journal of Environmental Science and Health. - 2017, Part B. - №52(8). – P. 537-556;
15. Wang H., Zúñiga-Pflücker J.C. Thymic microenvironment: interactions between innate immune cells and developing thymocytes. //Front Immunol. – 2022. -13:885280.

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