

**STUDIU COMPARATIV PRIVIND UNELE ASPECTE ALE MORFOLOGIEI
SISTEMULUI DIGESTIV LA MELCUL DE LIVADĂ (*HELIX POMATIA*), ÎN
PERIOADA DE HIBERNARE ȘI ÎN CEA DE ACTIVITATE**

**STUDY REGARDING SOME MORPHOLOGICAL ASPECTS OF ROMAN
SNAIL (*HELIX POMATIA*) DIGESTIVE SYSTEM IN HIBERNATION AND IN
THE ACTIVITY PERIOD**

D.NICA*, GABI DUMITRESCU*, M. BURA*, LILIANA CIOCHINA*

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USAMVB, Faculty of Animal Sciences and Biotechnologies, Aradului nr. 119, street, Timisoara,
300645, Romania.
nicadragos@k.ro

SUMMARY

The purpose of present study was to reveal the digestive system microscopic structure and to find the differences, which appear in its structure, during the hibernation. The researches took place on 10 snails *Helix pomatia* var. *banatica*, from which five were hibernating and five active. The results showed the presence of a low metabolic activity in hibernating snails, as a result of organism vital functions slowing till survival level. In accordance with those aspects, we observed changes of histological structure especially at the level of organs, which synthesize enzymes (digestive and salivary glands) and the decrease of digestive system cell dimensions, when the snail is hibernating.

Cuvinte cheie: operculare, *Helix pomatia*, sistem digestiv, structura microscopica

Key words: hibernation, *Helix pomatia*, digestive system, microscopic structure

INTRODUCTION

The hibernation is a latent state, when the snail metabolic activity decreases very much and his survival depends on the existing reserve of nourishing substances. In this process a key role is played by the digestive gland, in which is stocked all of the food supplies.

MATERIALS AND METHODS

The research took place in three consecutive steps:

Step 1

From a wide variety of anesthesia method we chose the one proposed by *Fox* (2001), which implies the introduction of the snails into a bowl containing $\frac{1}{4}$ ethanol and $\frac{3}{4}$ distilled water, 1h.

Step 2

We extracted the snail by broken away the shell in small pieces with a coarsed forceps, starting from junction point of mouth parietal region with the outer region to the body whorl (fig. 1). Then the snail body was washed, using a pad soaked in water or ethanol 80% in order to remove the mucus; this operation must be periodically repeted for preventing tissue deshidratation and for cleaning the mucus in excess.

The whorled columella was torn into pieces using a haemostat. In order to fix some marking points: the head, the leg and the visceral mass, we oriented the snail so we can identify the two major body axes: anteroposterior and dorsoventral.. We located the

buccal mass in the middle of the head and found the mouth. From this point we began to cut the snail body by a mediodorsal incision to the columellar muscle (fig.2).

We removed the anterior part of genital system with a fine dissecting scissors in order to facilitate the observation of digestive path and to sample parts of digestive tissues.

The alimentary canal is long and much looped. The mouth opens directly onto the buccal mass, the muscles of which operates the radula, a mobile chain of minute horny teeth which is moved back and forth like a rasp over the food. The radula lies on the floor of the mouth: at the front of the roof is mounted the horn jaw, which also cuts and scrapes the food.

From the buccal mass there is a thin oesophagus leading to a wider crop, which is overlain by salivary glands which open into the buccal mass. The crop in turn leads to the stomach, which continues with a long and thin intestine, much looped. The intestine terminates in the anus, which is situated very close to the respiratory pore. Much of the body space is occupied by the large, multi-lobed digestive gland in which much of digestion takes place.



Fig.1. Removing of the shell



Fig.2. Mediodorsal incision

Step 3

After we took samples from each major organ of the digestive system we realised the histological samples.

RESULTS AND DISCUSSIONS

The wall of the alimentary canal is composed from three tunics: mucous, muscular and serous membrane. We observed that there were some major differences between the microscopic structure of the alimentary canal tunics on active snails and on hibernating ones.

On hibernating snails (fig.3a) the mucous membrane of the crop presents very large folds, which have in sections a triangular shape and has no active glands. It is clothed by an prismatic, one layer epithelium, which is formed from two kind of cells: i) high cells, with an elapsed nucleus and a granular, basophil cytoplasm ii) bowled shaped cells, more numerous in the epithelium than at the folds base.

The epithelium lays on thin, basal membrane, intimately linked with the capillary network.

The corion of mucous membrane is extremely small and represents the support of the vascular network.

The muscular membrane is very thin and is composed from two layers of smooth *muscle*: one inner, circular layer and another external, longitudinal layer.

The snails sampled in the spring period (April-May) presented major changes in the structure of crop wall (fig. 3b). The organ mucous membrane presents a process of hypertrophy, characterized by an increase of fold number and dimensions.

The folds of mucous membrane have a rectangular shape, and some of them are even branched, with rounded peak. The epithelium which clothed them is puckered and slightly hypertrophic.

Now we can observe very clear the structure of salivary glands, inactive during winter time. They are tubulo-acinous glands, with a parenchyma made especially from serous glands, among which are found a small number of mucous glands.

The serous glands are elapsed structures, clothed with cylindrical cells, which have a round nucleus and a granular cytoplasm. The secretion products of the glands are drained off in long excretion canals, clothed in one-layer, cubic epithelium.



Fig.3.a

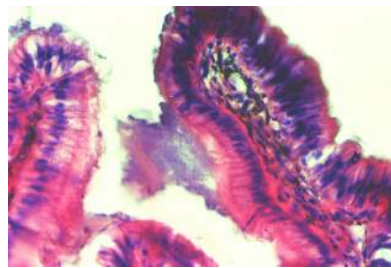


Fig.3 b

Fig.3 Microscopic structure of salivary glands

3a – hibernating snails

3b – active snails

The intestine sampled from hibernating snails (fig.4a.) presents higher, but thinner vilosities than those of active snails (their medium size is about 205.8μ).

The one-layer, prismatic epithelium is lower than that of active snails and is about 25μ . The vilosity corion is smaller compared with the basal one, but is more extended and presents large capillary.

The intestine of the active snails (fig.4b) is a canal with relatively fine walls, which presents a mucous membrane made of epithelium and a thin corion. It presents finger shaped vilosities (their dimensions are about $17 \times 9.5\mu = 161.5\mu$), from which one is more extended and overhung in the organ lumen.

The epithelium is extended, hypertrophic (40μ), made of one layer of extremely high cells, which presents elongated nuclei. Among this cells from place to place, we found a small number of clear cells, which probably secret mucus. One important characteristic of intestinal mucous membrane is that it presents no glands.

The digestive gland represents the biggest part of the visceral mass and covers up the intestine. In the axis of each vilosity, the corion is penetrated by a very thin fascicle of smooth muscle, which originated in the muscular membrane.

The corion of mucous membrane is small, made of lax connective tissue.

The muscular membrane is very thin and is made of two layers of smooth muscular fibers; one inner, longitudinal and another external, circular. Muscular cells from this tunic are elongated, fusiform, and present elongated, intensely chromatic nuclei.

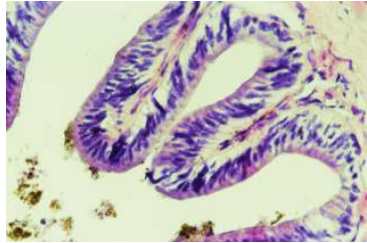


Fig.4a

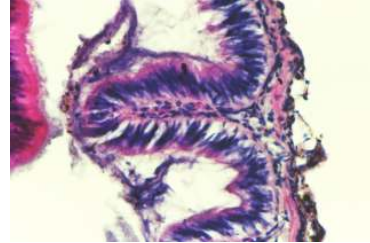


Fig.4b

Fig.4 Microscopic structure of intestine

4a – hibernating snails

4b – active snails

The transversal sections made through digestive glands on hibernating snails (fig.5a), reveal the elapsed aspect of lobules and the presence of some very small interlobular gaps. Each lobule has the wall clothed with large, polygonal shaped cells which lay on a thick basal membrane, doubled outside by a thin muscular fascicle. The nucleus of this cell is large, circular, with granular, chromatin. The cytoplasm is full with fine grains, which probably can indicate the presence of the endoplasmatic reticulum and with some products of enzymatic secretion, which are involved in digestion.

Lobular lumen contains a granular product, which probably came from the stomach.

In parenchyma structure among lobules we find some canals, with large lumens, clothed in a wrinkled mucous membrane, similar with the intestinal one.

A common characteristics of lobules is that the cells which clothed them are found in small number, have large dimensions, hypertrophic nuclei and granular cytoplasm.

Active snails (fig.5b) present smaller lobules, clothed by polygonal cells. Their cytoplasm is full with fine grains, probably caused by the synthesis of cellulase.

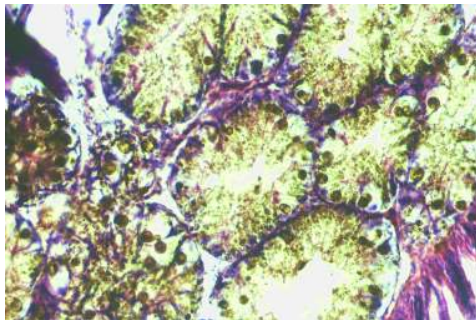


Fig.5a

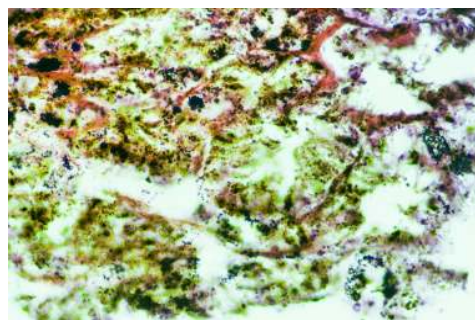


Fig.5b

Fig.5 Microscopic structure of digestive glands

5a – hibernating snails

5b – active snails

CONCLUSIONS

1. When a snail enters in hibernation his metabolic activity decreases till the survival level, so that a lot of changes take place in the structure of alimentary canal, changes which are externalized at the level of the organs involved in protein synthesis (salivary and digestive glands). Also, after the feeding interruption appear retreats of the alimentary canal cell dimensions. During this entire period the snail survives due to food reserves stocked in the digestive glands.

2. The crop of the hibernating snails presents an aglandular mucous membrane, with very high, triangular folds; the salivary glands are inactive.

The crop of the active snail is characterized by an increase of folds number and dimensions and by the presence of active salivary glands, which have tubulo-acinous structure. Also is made of smaller, rectangular folds, with a wrinkled, hypertrophic mucous membrane.

3. The intestine of the hibernating snail presents higher and thinner vilosities (205.8μ), with a prismatic, one-layer epithelium (cell dimension = 25μ).

The vilosities of active snails are finger shaped, uniform in dimensions (about 161.5μ) and present a one-layer, extended, hypertrophic epithelium (cell dimension = 40μ) made of large cells, with elongated nuclei. From the vilosities, one is branched, much extended and overhung in the organ lumen.

4. The digestive glands of hibernating snail presents a lobular structure, with very small interlobular gaps: in each lobule the wall is clothed by large, polygonal cells, with slightly granular or clear cytoplasm, so arranged that they mark of a inner lumen.

The active snails have smaller lobules, clothed by polygonal cells, with densely granular cytoplasm.

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