



*Original Contribution*

**TONSILLA PARAEPIGLOTTICA IN THE BULGARIAN  
WHITE × LANDRACE PIG CROSSES - MORPHOLOGICAL TRAITS AND  
SOME MORPHOMETRICAL INVESTIGATIONS**

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**ABSTRACT**

The data about the topography and morphology of the paraepiglottic tonsil (*tonsilla paraepiglottica*; TPE) in pigs are not enough. The purpose of the present investigation was to determine its topography, morphological traits and some morphometric parameters in Bulgarian White × Landrace pig crosses.

It was found that TPE was situated in pars laryngea pharyngis, dorsolaterally to vallecula epiglottica on the lateral surface of lig. thyroepiglotticum. It is a paired macroscopically visible formation with grooves and the following dimensions (mean ± SEM): length – 15.8±0.4 mm in male and 16.2±0.4 in female; width – 8.3 ± 0.1 mm in male and 8.2±0.1 mm in female. The shape of the tonsil is mainly elliptical, and in some instances – oval. It is sharply delineated and protruded over the adjacent tissues.

On longitudinal sections, the number of lymph nodules was 75.0±0.9 in male and 76.2±0.9 in female pigs, whereas on transverse sections – 33.4 ± 0.9 and 34.9±0.9 respectively. The stratified epithelium of the tonsil located on the part of recessus piriformis, was infiltrated with lymphocytes at some areas. The tonsillar crypt numbers on longitudinal sections were 6.6±0.2 and 6.8±0.2 in male and female pigs, respectively, and on transverse sections - 6.5 ± 0.1 (male) and 6.4±0.1 (female). The base of the tonsil was differentiated from adjacent tissues by a well-defined connective tissue capsule.

**Key words:** paraepiglottic tonsil, lymph nodules, pig crosses

**INTRODUCTION**

The tonsils are generally the site of the early contact with infectious agents, and the local antibody production is important for the rapid initial immune response, and for subsequent preservation and maintenance of immunobiological systemic homeostasis (1). The tonsils are lymphoepithelial structures that prevent the distribution of the infection from the nose and the mouth to the deeper parts of the respiratory and alimentary tracts (2).

The paraepiglottic tonsil (PET) is a paired

structure in pigs, sheep, goats and cats, bilaterally located to the epiglottis (3, 4).

According to Nickel et al. (4), the size of PET in pigs is about 5-8 mm in length and 3-4 mm in width. The authors have provided no information about the shape or about any sex- or breed-related features in TPE size. Other authors, having studied these tonsils in sheep, established their dimensions at 5-14 mm (length) and 2-5 mm (width) (5, 6, 7, 8).

The pathological processes affecting the tonsils make them important not only from a morphological, but from a clinical point of view (1). That is why, it is essential to obtain more information about their localization, dimensions and structure.

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Having in mind the scarce data in the literature, our aim was to investigate the topography, the shape, size and morphological traits of the paraepiglottic tonsil in Bulgarian White  $\times$  Landrace pig crosses.

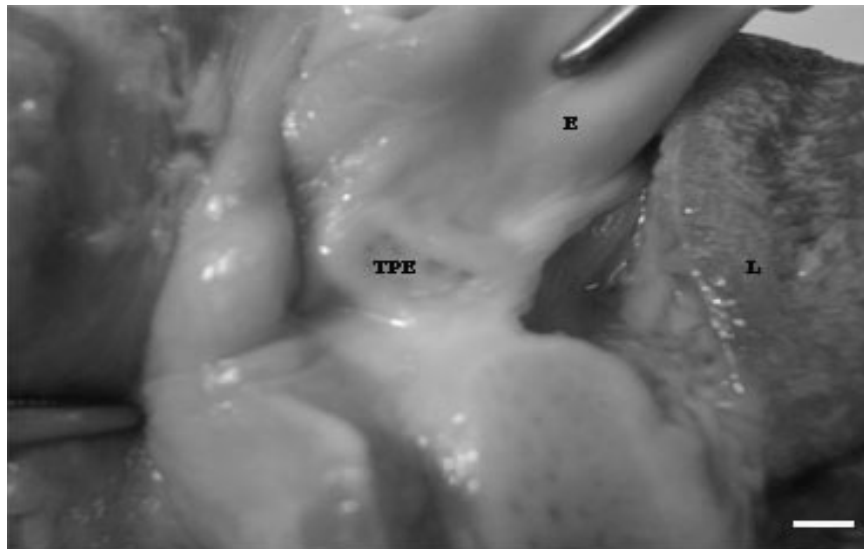
#### MATERIAL AND METHODS

In this study, 40 tonsils from 20 healthy pigs (10 male and 10 female) at the age of 8 months, Bulgarian White $\times$ Landrace crosses, weighing 110–120 kg were used. The animals were obtained from certified slaughterhouses in Stara Zagora in accordance with the Bulgarian law for humane treatment of animals. The larynges with tonsils were carefully prepared from the body, as soon as possible after slaughtering. The material for histological examination was placed in 10% neutral formalin for 48 hours. Then it was washed, dehydrated, cleared and embedded in paraffin. Transversal sections of 5–6  $\mu$ m were

stained with haematoxylin as per Erlich/eosin (9). Morphometry was done with a graphing paper, ruler, caliper gauge, immediately after slaughtering and on the durable histological slides with eyepiece micrometer mounted in the light microscope (Hunt, Germany) (10). Macroscopic photographs were documented with a digital camera Canon Power Shot A 450, and microscopic ones – with Digital camera MDCE-5. Data were statistically processed with computer programme (StatMost for Windows).

#### RESULTS

In this study it was established, that the paraepiglottic tonsil in Bulgarian White $\times$ Landrace pig crosses was located in pars laryngea pharyngis, dorsolaterally to vallecule epiglottica along the lateral surface of lig. thyroepiglotticum (**Fig.1**).



**Fig. 1.** Location of the paraepiglottic tonsil (TPE) against the epiglottis (E). Oe – oesophagus, FP – recessus piriformis, bar= 1 cm.

Macroscopically, the tonsil appeared as a paired organ with mainly elliptical and less frequently rounded shape, with grooves and the following dimensions (mean  $\pm$  SEM): length – 15.8 $\pm$ 0.4 mm in male and 16.2 $\pm$ 0.4 in female; width – 8.3  $\pm$  0.1 mm in male and 8.2 $\pm$ 0.1 mm in female (**Table 1**). There was no statistically significant difference in organ's size with regard to gender.

It was found out that the Bulgarian White  $\times$  Landrace pigs' tonsil had a same formed and diffuse lymphoreticular system, located in the propria. It was lined with a pharyngeal

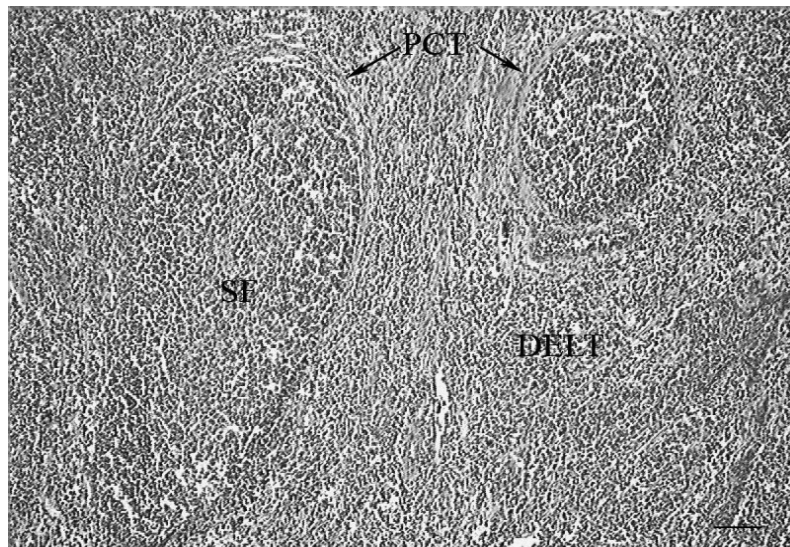
stratified epithelium and was clearly differentiated from the adjacent tissue by a well shaped capsule of thick connective tissue. The formed lymphatic system was represented by lymph follicles with oval shape, restricted by fine connective tissue layers on the side of the parafollicular tissue (**Fig. 2**). A number of clusters of lymphoid follicles and crypts were formed, limited with connective tissue septae protruding from the capsule towards the propria. Most lymph follicles were secondary and had a germinative centre with a light and a dark zone (**Fig. 3**). The light zone was formed by smaller lymphocytes. Around, lymphocytes

formed a mantle zone. Primary follicles were deprived of germinative centre and appeared as basophilically stained formations of densely arranged small-sized lymphocytes and reticular tissue (Fig. 4). The stratified epithelium lining the lymphoid tissue, were infiltrated with lymphocytes at some sites (Fig. 3). The crypts began from the epithelial surface (Fig. 4). On longitudinal sections,  $75.0 \pm 0.9$  lymphoid

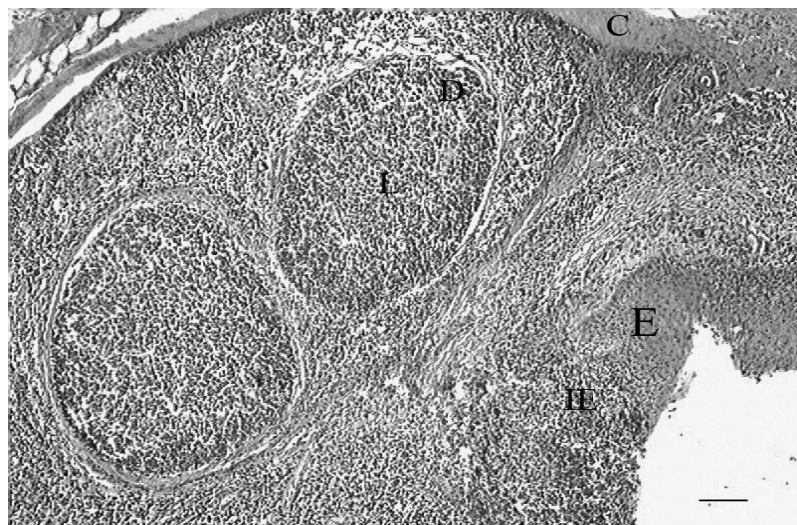
follicles were enumerated in male pigs and  $76.2 \pm 0.9$  in female, whereas on transverse sections –  $33.4 \pm 0.9$  in male and  $34.9 \pm 0.9$  in female ( $p < 0.001$ ). The number of crypts was on the average  $6.6 \pm 0.2$  (male) and  $6.8 \pm 0.2$  (female) on longitudinal sections and  $6.5 \pm 0.1$  (male) and  $6.4 \pm 0.1$  (female) – on transverse sections ( $p > 0.05$ ) (Table 2).

**Table 1.** Dimensions (mm) of the paraepiglottic tonsil (TPE) in Bulgarian White×Landrace pig crosses.

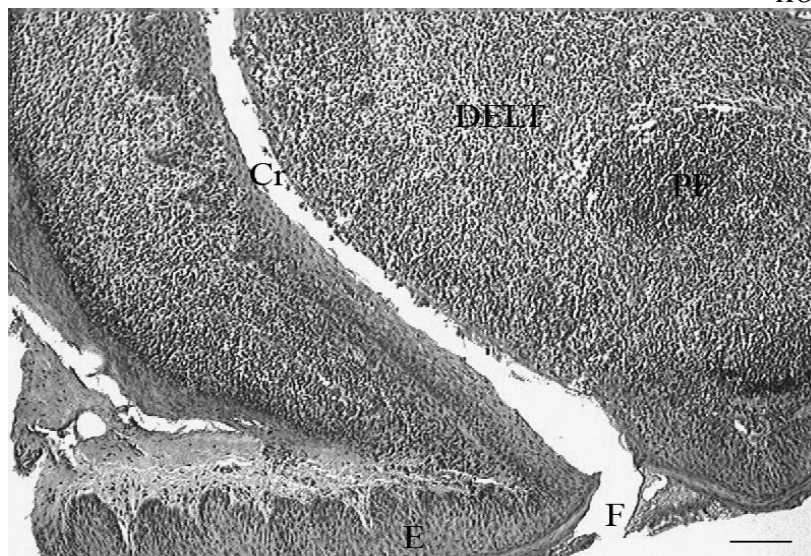
Parameter	TPE - male	TPE - female
Number of transverse sections	50	50
Length (mm) (min. – max)	$15.8 \pm 0.4$ 11-20	$16.2 \pm 0.4$ 11-20
Width (mm) (min. – max)	$8.3 \pm 0.1$ 7-10	$8.2 \pm 0.1$ 7-10



**Fig. 2.** Lymph follicles restricted by fine connective tissue layers on the side of the parafollicular tissue. SN – secondary nodule, PCT – perifollicular connective tissue, DELT – diffuse lymphoid tissue, H/E, bar= 160 μm



**Fig. 3.** Secondary follicles. C – capsule, E – epithelium, IE – epithelium infiltrated with lymphocytes, D – dark zone, L – light zone, H/E, bar= 160 μm



**Fig.4.** Transverse cross sections of a crypt. DELT – diffuse lymphoreticular tissue, PF – primary follicle, Cr – crypt, F - groove, H/E, bar= 160  $\mu$ m.

**Table 2.** Number of lymph nodules and crypts in longitudinal and transverse sections of the paraepiglottic tonsil (TPE) in Bulgarian White  $\times$  Landrace pig crosses.

Parameter	longitudinal section - male	longitudinal section - female	transverse section - male	transverse section - female
Number of transverse sections	50	50	50	50
Number of lymphoid follicles per transverse section (min. – max)	75.0 $\pm$ 0.9	76.2 $\pm$ 0.9	33.4 $\pm$ 0.9	34.9 $\pm$ 0.9
Number of crypts per transverse section (min. – max)	63-85	62-88	20-48	21-45
	6.6 $\pm$ 0.2	6.8 $\pm$ 0.2	6.5 $\pm$ 0.1	6.4 $\pm$ 0.1
	4-10	4-10	5-9	5-8

## DISCUSSION

In this study we are the first to present the information about the shape and dimensions of TPE in Bulgarian White  $\times$  Landrace pig crosses at the age of 8 months. Unlike data reported by Nickel et al. (4), we established almost twice bigger dimensions of the tonsil in studied pig crosses at this age. Furthermore, we added to existing information the fact that TPE had mainly an elliptical shape. According to cited authors, TPE dimensions varied between 5-8 mm in length and 3-4 mm in width, they were poorly developed in young animals and in adults, they were well differentiated structures. The authors have not

provided data about the shape, as well as for any breed- or gender-related differences in TPE size.

According to Barone (3), TPE were located in pars laryngeal pharynges, laterally to the base of the epiglottis. The location of these tonsils is determined by Nickel et al. (4) as bilateral against the epiglottis. Our results support the findings of cited authors. We have found out that tonsils were situated along the lateral surface of lig.thyroepiglotticum, ventrolaterally to the epiglottis at the bottom of recessus piriformis.

These tonsils have also been investigated in sheep at the age of 6 to 12 months, and reported dimensions of the organ were as followed: length 5-14 mm, width 2-5 mm (7). As reported by authors, the tonsil was situated laterally to the epiglottis in the ventromedial segment of the pharyngeal wall, on the bottom of Recessus piriformis, likewise in pigs. Unlike sheep, where TPE is hardly distinguishable macroscopically, the organ in pigs is a well shaped clearly visible formation with a peripheral raised border and a concave central part, forming a groove – sulcus tonsillaris.

We have found no reports about the shape of TPE in pigs. As per our observations, the elliptical shape prevailed, and oval shape was encountered more rarely.

Our results of histological examination showed a similarity between the histostructure of pig tonsil with that of sheep, described by Cocquyt et al. (7). In the view of these authors, the stratified epithelium covered the lymphoid tissue was commonly infiltrated with lymphocytes forming a follicle-associated epithelium, as also observed by us in pigs. Dellman & Eurell (1) described that the epithelium of tonsils with grooves was usually infiltrated with lymphocytes, neutrophils and macrophages, leukocytes reaching the lumen, are designated as salivary particles. When they are not washed from crypts' opening with salivary gland secretion, these cells, together with microorganisms, could obstruct the openings and to provoke an inflammation.

Similarly to Cocquyt et al. (7), we observed that most lymphoid follicles were secondary, composed of germinative centre, dark zone and mantle zone. Primary follicles had no germinative centre. The dark zone according to Dellman & Eurell (1) consisted of large B-lymphoblasts whereas the light zone was formed by smaller lymphocytes around it small lymphocytes formed a mantle zone. These zones were differentiated in the present study. For the first time, we have enumerated the lymph nodules and crypts. On a longitudinal section lymph follicles were almost twice more numerous than on a transverse section, with statistically significant difference ( $p < 0.001$ ). More crypts were also observed on

longitudinal versus transverse sections ( $p > 0.05$ ).

## CONCLUSION

The dimensions of paraepiglottic tonsil in studied pig crosses suggested that, they could be probably attributed to a breed trait. The information about the shape, dimensions and morphological structure of TPE in pigs could be used by morphologists and clinical practitioners in the diagnostics of various diseases affecting tonsils of this pig strain.

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