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Histological and Histochemical Studies on The Alimentary Canal of Spur-Winged Lapwing *Vanellus spinosus*

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ABSTRACT

Aim of the work: The present study aims to describe and compare between the different parts of the alimentary canal of Spur-winged lapwing *Vanellus spinosus* from the histological and histochemical reviews.

Materials and methods: This animal was caught from its natural habitat (Nile Delta in Egypt); dissected and the alimentary canal was fixed in the suitable fixatives for histological and histochemical investigations.

Results: Histological findings revealed that the alimentary canal wall in different parts under investigation is consisted of four main layers which are; serosa, muscularis, submucosa and mucosa. The serosa is composed of simple squamous epithelium. The muscularis is formed of outer circular and inner longitudinal muscle fibers. The submucosa is showing green colour with Masson's stain due to its content of connective tissue. The mucosal folds of oesophagus are characterized by stratified squamous epithelium. At the base of these folds, oesophageal glands which secrete acid mucopolysacchride are located. The stomach composed of two parts; cardiac (glandular) and pyloric (muscular). The gastric glands of glanular portion are differentiated into deep and superficial gastric glands. The deep gastric glands are of compound-branched alveolar and have neutral mucopolysacchride secrections. While, the superficial gastric glands are of compound tubular type and secreting acid and neutral mucopolysacchride since they give blue and red colours with Alcian PAS stain. The gastric glands in muscular portion of stomach, are compound tubular type and have acid and neutral mucopolysaccharides. The mucosal villi of duodenum and ileum are characterized by tubular glands (crypts of Leiberkhün), which contain acid and neutral mucopolysaccharides. The mucosal layer of rectum is covered by simple columnar epithelium containing goblet cells in addition to the rectal glands. This layer nature is acid and neutral mucopolysaccharides. The histochemical results showed differences in the stainability and distribution of polysaccharides, acid and neutral mucopolysaccharides in different parts of alimentary canal of investigated animal.

Keywords: bird, Spur-winged lapwing, alimentary canal, histology, histochemistry.

INTRODUCTION

Spur-winged lapwing (*Vanellus spinosus*) is belonging to order, Charadriiformes, family, Charadriidae. It feeds on insect, plants, invertebrates, which are picked from the ground.

Many studies has been concerned with the microscopic structure of the gastrointestinal tract of vertebrates. The mucous membrane of avian stomach showed neutral glycoproteins, sialo and sulphosaccharides[1]. A comparative histological and histochemical study was carried out on the stomach of few numbers of vertebrate species belonging to classes Amphibia, Reptilia, Aves and Mammalia[2]. Certain differences in the histochemical reactivities of mucopolysaccharides in the histochemical structure of their alimentary tracts[1,2]. With special reference to oesophageus, stomach, small and large intestine, many studies on birds have been reported [3,4,5].

The aim of this investigation is to study the microscopic structure with histochemical reference of oesophagus, stomach, duodenum, ileum and rectum of Spur-winged lapwing (*Vanellus spinosus*).

MATERIALS AND METHODS

Histological and Histochemical preparations:

Tissue samples of the alimentary canal from Spur-winged lapwing (*Vanellus spinosus*) were immediately excised, fixed in 10% neutral formalin solution, dehydrated in ascending series of ethyl alcohol, cleared in terpineol and embedded in paraffin wax. Sections of 4-6 µm thick were stained with haematoxylin and eosin, microscopically examined and photomicrographs were made as

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required[6]. Alcian PAS staining method was used to demonstrate the mucopolysaccharides[7]. Masson's trichrome staining method was used to demonstrate muscles and connective tissue [8].

RESULTS

1- The oespahgus

Histologically, the oesopahgus of *Vanellus spinosus* consists of four main layers; serosa, muscularis, submucosa and mucosa. The serosa is thin layer of simple squamous epithelium. This layer is followed by a well developed muscularis that consists of two layers of muscle fibers, circular muscle fibers outwards and longitudinal muscle fibers inwards. The submucosa is formed of connective tissue which gives green colour with Masson's stain (Fig. 1).

The mucosa is the innermost layer which lines the cavity of the oesophagus. It consists of numerous longitudinal folds of different shapes and depths. These folds are lined with stratified squamous epithelium (Fig. 2).

Oesophageal glands are located at the base of the mucosal folds. These oesopahgeal are of tubular type and give blue colour with Alcian PAS due to the presence of acid mucopolysacchride secrections (Fig. 3).

2- The stomach

The stomach in *Vanellus spinosus* is divided into cardiac and pyloric portions. The gastric wall is composed of the following layers; serosa, muscularis, submucosa and mucosa. The serosa is formed of simple squamous epithelium. The muscularis consists of outer circular and inner longitudinal muscle fibers (Fig. 4). The submucosa is rich in connective tissue. The mucosal layer contains a large number of glands. In cardiac portion, gastric glands are differentiated into deep and superficial gastric glands. The deep gastric glands are of compound-branched alveolar type lined with simple cuboidal epithelial cells. The superficial gastric glands are of compound tubular type. The glandular tubules of each of these glands discharge their secretions into a common chamber which is called the lumen (Fig. 5).

The mucosal glands of pyloric portion of stomach are compound tubular type lined with epithelial cells. Also, this layer is lined with a thin keratin-like layer known as cutica gastrica (Fig. 6).

The superficial gastric glands give red colour with Alcian PAS stain due to the presence of neutral mucopolysacchride secrections. The mucosal wall of gastric glands is composed of columnar cells which secrete acid and neutral mucopolysacchride since they give blue and red coulours with Alcian PAS stain (Fig.7).

3- The small intestine

The examination of histological sections of the duodenum and ileum of *Vanellus spinosus* revealed that they consist of serosa, muscularis, submucosa and mucosa. The muscularis consists of two layers; outer circular and inner longitudinal muscle fibers. The submucosa is a thin loose connective tissue contains number of lymphocytes and blood capillaries. The mucosal villus consists of simple columnar epithelium and containing goblet cells resting on a basement membrane (Fig. 8). Also, the mucosa is invaginated at the bases of villi into tubular glands (crypts of Leiberkhün) which are continuous with the columnar epithelium (Fig. 9). Application of Alcian PAS method revealed that, the crypts of Leiberkhün contain acid and neutral mucopolysaccharides. The columnar cells contain acid mucopolysaccharides (Fig. 10).

4- The large intestine

The wall of the rectum of *Vanellus spinosus* consists of serosa, muscularis, submucosa and mucosa. The serosa is a thin layer composed of simple squamous epithelium with flattened nuclei. The muscularis is made up of outer longitudinal and inner circular muscle fibers. The submucosa consists of connective tissue rich in blood vessels. The mucosa is thrown up into numerous leaves-like villi, all covered by simple columnar epithelium containing goblet cells (Fig.11). At the base of the mucosal folds, rectal glands (simple tubular) are located (Fig. 12). These glands are lined with simple columnar epithelium and goblet cells. Application of Alcian PAS method revealed that, these glands contain acid and neutral mucopolysaccharides while the goblet cells contain acid mucopolysaccharides (Fig. 13).

EXPLANATION OF FIGURES

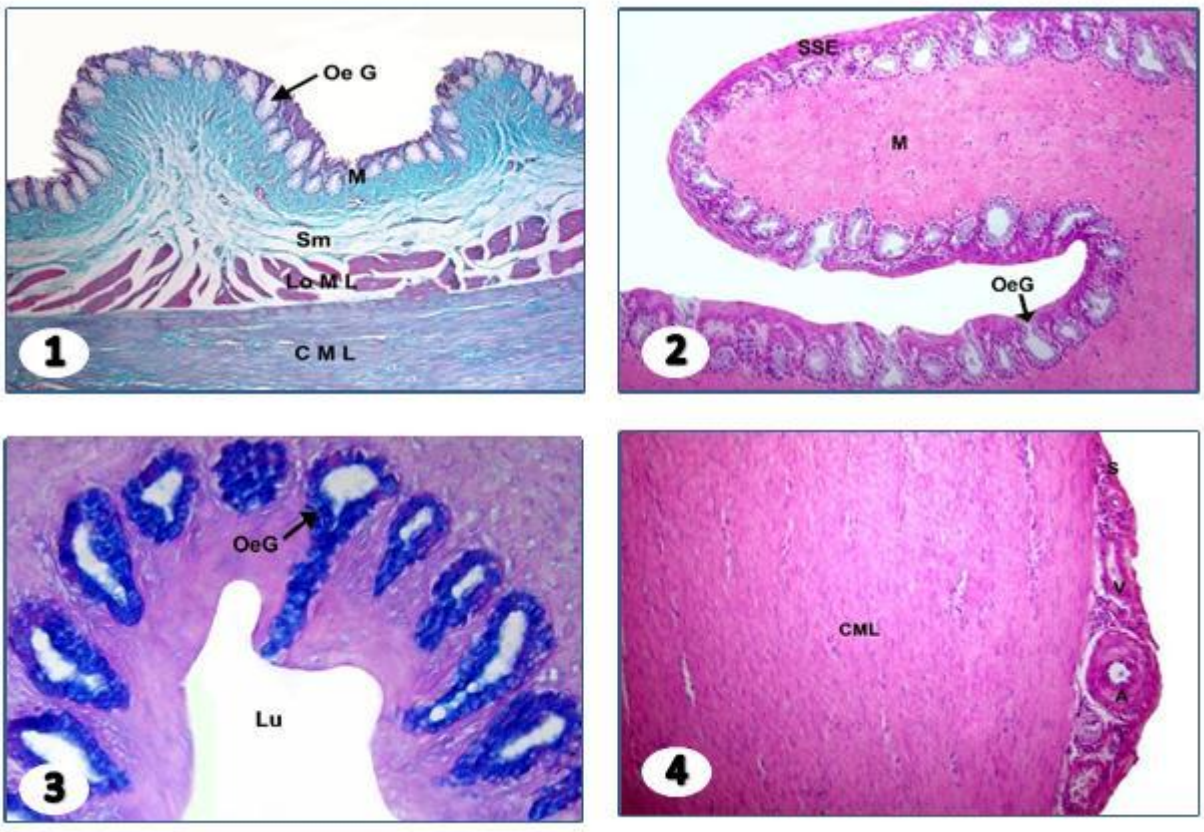

Fig. (1): Photomicrograph of a transverse section of the oesophagus of *Vanellus spinosus* showing the circular muscle layer (CML), longitudinal muscle layer (LoML), submucosa (Sm), mucosa (M) and oesophageal gland (OeG).

(Masson's trichrome stain X. 100)

Fig. (2): Photomicrograph of a transverse section of the oesophagus of *Vanellus spinosus* showing the mucosa (M) and oesophageal gland (OeG).

(H&E. stain X. 100)

Fig. (3): Photomicrograph of a transverse section of oesophagus of *Vanellus spinosus* showing acid mucopolysacchride secretion of oesophageal gland (OeG).

(Alcian PAS. stain X. 200)

Fig. (4): Photomicrograph of a transverse section of stomach of *Vanellus spinosus* showing the Serosa(S), longitudinal muscle layer (LoML) and blood vessels (A, artery & V, vein).

(H&E. stain X. 200)

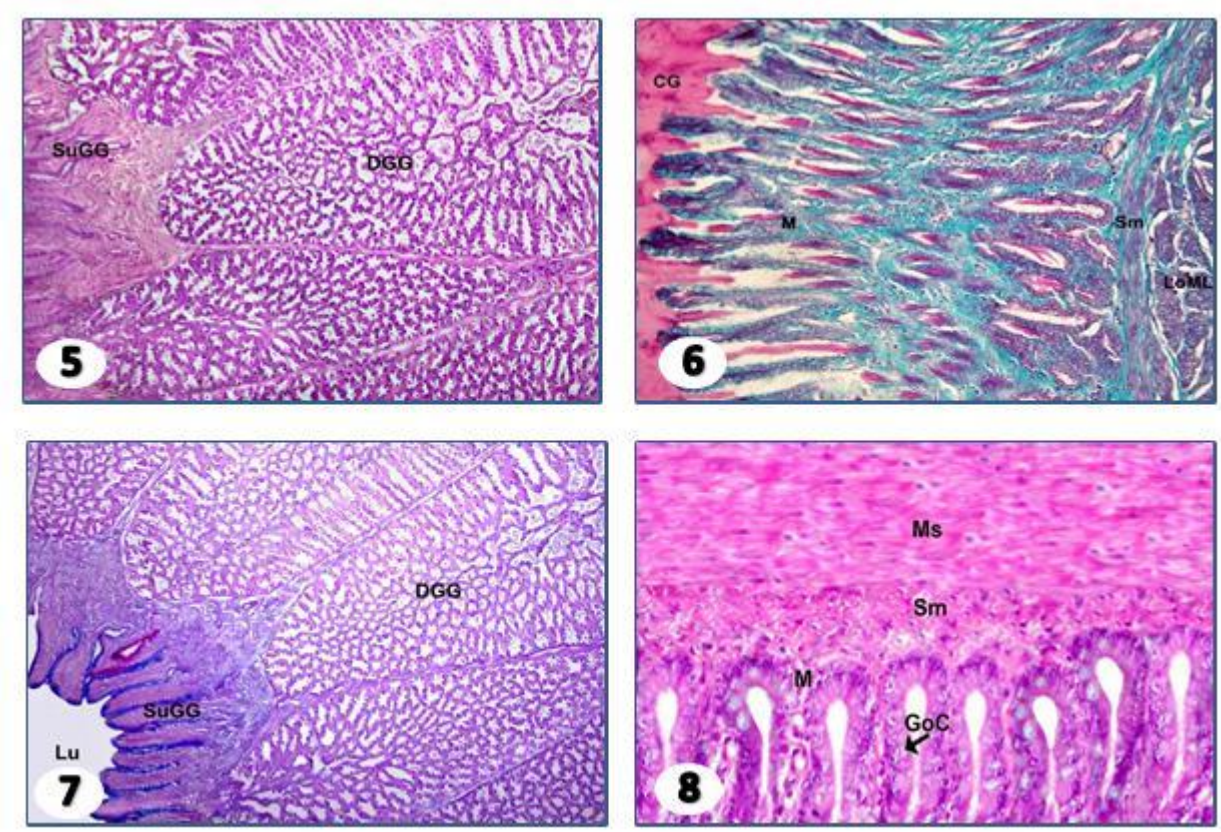

Fig. (5): Photomicrograph of a transverse section of stomach of *Vanellus spinosus* showing the deep gastric gland (DGG) and superficial gastric gland (SuGG).

(H&E. stain X. 100)

Fig. (6): Photomicrograph of a transverse section of stomach of *Vanellus spinosus* showing the longitudinal muscle layer (LoML), submucosa (Sm), mucosa (M) and cutica gastrica (CG).

(Masson's trichrome stain X. 200)

Fig. (7): Photomicrograph of a transverse section of stomach of *Vanellus spinosus* showing the neutral mucopolysacchride secretion of deep gastric gland (DGG) and the acid & neutral mucopolysacchride secretions of superficial gastric gland (SuGG).

(Alcian PAS. Stain X. 100)

Fig. (8): Photomicrograph of a transverse section of the duodenum of *Vanellus spinosus* showing the, muscularis (Ms), submucosa (Sm), mucosa (M) and goblet cell (Goc).

(H&E. stain X. 400)

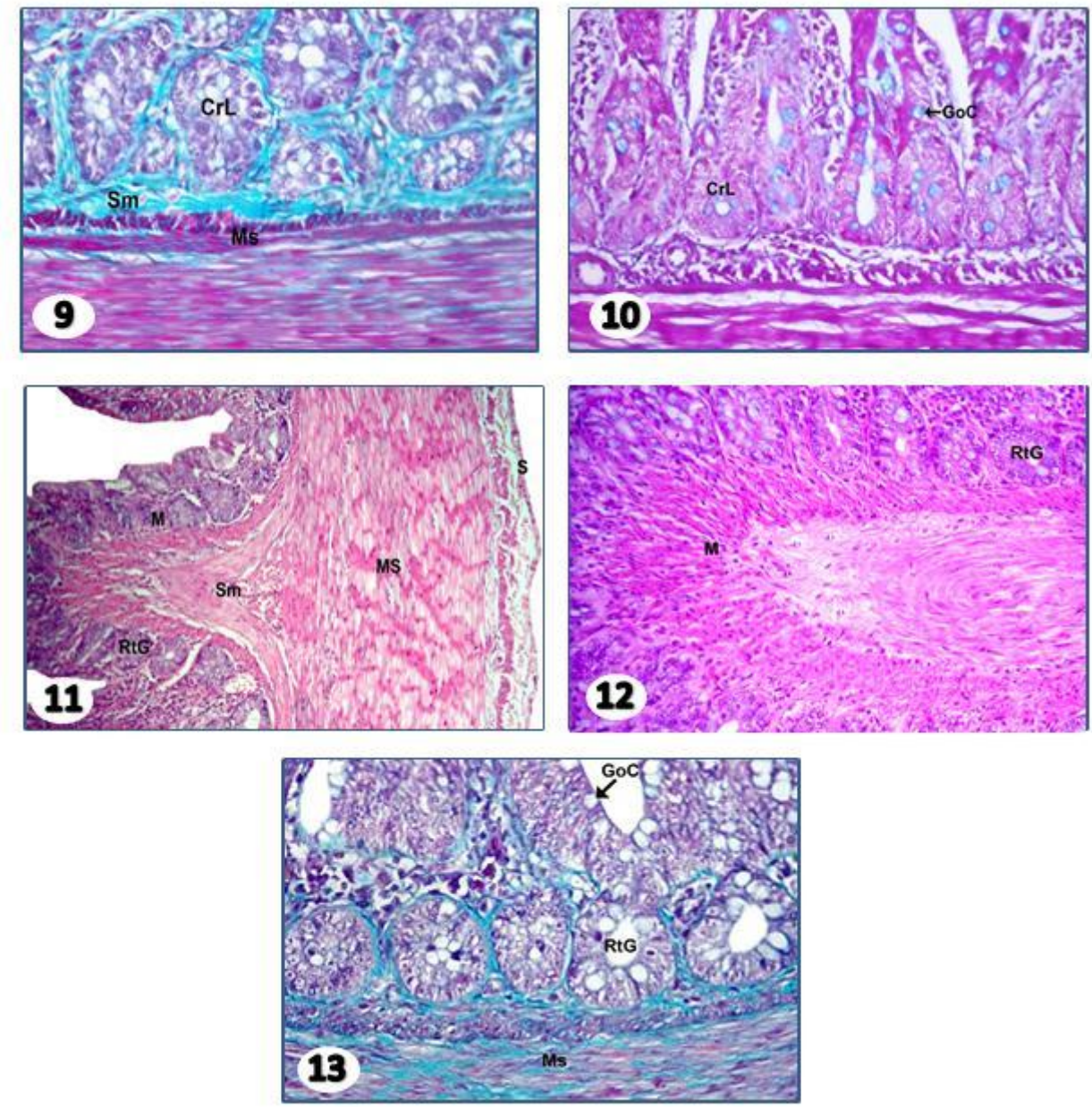

Fig. (9): Photomicrograph of a transverse section of the ileum of *Vanellus spinosus* showing the muscularis (Ms), submucosa (Sm) and crypts of Leiberkhün (CrL).

(Masson's trichrome stain X.400)

Fig. (10): Photomicrograph of a transverse section of duodenum of *Vanellus spinosus* showing the acid & neutral mucopolysaccharide secretions of crypts of Leiberkhün (CrL) and acid mucopolysaccharide secretion of goblet cell (Goc).

(Alcian PAS. Stain X. 400)

Fig. (11): Photomicrograph of a transverse section of the rectum of *Vanellus spinosus* showing the serosa (S), muscularis (Ms), submucosa (Sm), mucosa (M) and rectal gland (RtG).

(H&E. stain X.200)

Fig. (12): Photomicrograph of a transverse section of the rectum of *Vanellus spinosus* showing the mucosa (M) and rectal gland (RtG).

(H&E. stain X. 400)

Fig. (13): Photomicrograph of a transverse section of the rectum of *Vanellus spinosus* showing the , muscularis (Ms), rectal gland (RtG) goblet cell (Goc).

(Masson's trichrome stain X. 400)

DISCUSSION

The present investigation aimed to illustrate the histological structure and the differences of histochemical characteristics in the different parts of alimentary canal of *Vanellus spinosus*. Histological results obtained in the present investigation revealed that the alimentary canal of *Vanellus spinosus* consists of four main layers; serosa, muscularis, submucosa and mucosa[9]. The oesophageal layers are three; serosa, muscularis and mucosa[10,11].

Muscularis layer is well developed and consists of two layers of muscle fibers; circular muscle fibers outwards and longitudinal muscle fibers inwards. The muscularis is composed of outer longitudinal and inner circular muscle fibers[12, 13]. The muscularis is formed of circular muscle layer in their studies on germain's swiftlet and Grey-Backed Shrike respectively[11,14].

The mucosa is the innermost layer which lines the cavity of the oesophagus. There is no keratinization in this layer[12,13,15]. These glands are compound alveolar in their investigations on Fowl and Emu birds, respectively[13, 16].

The secretions of the oesopahgeal glands of *Columba palumbus* and *Tyto alba* are acid mucopolysacchrides[12]. The secretions are acid and neutral mucopolysacchides[9,11].

The stomach in *Vanellus spinosus* is divided into cardiac and pyloric portions[17]. The cardiac portion is glandular and the pyloric is muscular. The gastric layers are; serosa, muscularis, submucosa and mucosa[18,19,20]. The serosa made up of simple squamous epithelium[21]. The muscularis of *Vanellus spinosus* consists of outer circular and inner longitudinal muscle fibers[22]. The circular layer is the inner layer and the longitudinal is the outer one in ostrich[23]. The mucosal layer has not cuticle in the proventriculus[24]. This layer is thin[25]. The proventricular glands in *Vanellus spinosus* are differentiated into deep and superficial[26]. The deep gastric glands are of compound-branched alveolar[23]. The superficial gastric glands are compound tubular. The secretions of the proventricular glands of *Vanellus spinosus* are acid and neutral. The secretions are only neutral[27.] The secretions are acid secretions[28].

In *Vanellus spinosus*, the mucosal glands of pyloric portion of stomach are compound tubular type[29].The glands are of tubuloalveolar type in red-jungle fowl[3]. The mucosal layer is lined with a thin keratin-like layer known as cutica gastrica[26,30]. The role of cutica gastrica in the protection of gastric mucosa from secretionssuch as pepsin enzyme[31]. The gastric glands have acid and neutral mucopolysaccharides[32,33].

In the small intestine of *Vanellus spinosus*, the muscularis consists of two layers; outer circular and inner longitudinal muscle fibers. The muscularis consists of outer longitudinal and inner circular[31,34,35]. The mucosal villi are composed of simple columnar epithelium containing goblet cells[5,36]. The role of epithelial cells in increasing the absorption of villi surface[37,38,39]. The tubular glands (crypts of Leiberkhün) are located at the basal region of mucosal folds[15,23,40]. Application of Alcian PAS method reported secretions with acid and neutral mucopolysaccharides[28].

The mucosal layer has neumerous leaf-like villi which are coverd by simple columnar epithelium containing goblet cells[34]. This finding agreed with Abd El-Aziz in *Ardeola ibis ibis*. The rectal glands (simple tubular) are located at the base of mucosal folds and lined with simple columnar epithelium and goblet cells. Application of Alcian PAS method revealed that, these glands contain acid and neutral mucopolysaccharides while the goblet cells contain acid mucopolysaccharides[41].

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