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Histological Study of the Ovary of the *Gallus Gallus* Hen (Of Dzaye Breeds) In Cote D'ivoire.

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Abstract
Background*: Several studies on chickens have been conducted on the European, American and Asian continents. However, according to the literature, there is little data on African chickens, particularly those from the Ivory Coast. The present study is conducted on the African chicken Gallus gallus to overcome the lack of data on this species. It focuses on specimens of Gallus gallus of the so-called Dzaye breed in Côte d'Ivoire. The study concerns the histology of the reproductive system of the Gallus gallus hen.*
Materials and Methods*: a sample of hens called DZAYE represents the biological material. After euthanasia and dissection of the birds, histological treatments and observation with an optical microscope allowed the study of the structure of the ovary*
Results
Following histological treatments and light microscopic observation, the hen's ovary consists generally of a cortex housing the ovarian follicles, the cortical stroma, interstitial cells and the highly vascularized medulla. The hen's follicle shows from the inside to the outside a yolk-laden cytoplasm and a very thick wall with several cell layers.
Conclusion
Histological processing and microscopic observation of the hen's follicle shows a wall and yolk. The wall consists of a thin layer of connective tissue from the outside to the inside, topped by collagen fibers, smooth muscle tissue and a space above. A thin membrane separates the cells from the vitelline inclusions. The yolk consists of several vesicles.
Key words*: Hen Gallus gallus, Ovary, histology*

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I. Introduction

The class Birds includes two subclasses: the class Archaeornithes and the class Neornithes [1]. The latter includes the present-day birds. It is divided into two super-orders. The order of the Paleognathes, which represents the birds unable to fly, and the order of the Neognathes, which has the ability to fly and includes chickens[2]. According to[3], this subspecies has a very wide geographical distribution, and has therefore adapted to a multitude of environments due to human activity[4]. Thus, thanks to this anthropic activity, this subspecies has colonized all five continents, particularly the African continent[5]. Studies on poultry, especially chickens have been conducted on almost all continents, namely the European, American, Asian and African continents[6]. These studies include morphology[7,8], external anatomy[7,9], genetics[10,11], aviculture[12,13 ,14], avian epidemics[15,16].

In Africa, there is almost no data on African chickens, especially from Côte d'Ivoire, covering the different areas mentioned above[17]. According to these authors, data on African chickens are still basic and insufficient given the importance of these birds in the diet of the population. According to some information gleaned from the poultry literature in Africa, there are no local African breeds of chickens, but rather "African populations of chickens" with a wide variety of plumages or phenotypes with some common traits[18,19].

Indeed, the so-called local African breeds are defined according to the coloration and distribution of plumage on the body[20,21]. As an example, we have the Bochibolochié breed (white tail, with the rest of the plumage varying), the Kokochié breed (with white breast plumage, the rest of the body plumage is black), the Yarachié breed (white and black plumage) the Wolochié breed (with partridge plumage), the Balachié breed

(with curly plumage), the Sagachié breed (with silky plumage), the Dzaye breed (with all-white plumage), the Wassachié breed (golden red plumage) [22].

The specimens concerned in the present work are those of the so-called "Dzaye" races. In Africa, in all the specimens of these different breeds mentioned, no histological study has been done at the organ level. In order to overcome this deficiency, the laboratories of Cell Biology and Pharmacodynamics-Biochemistry of the University Félix Houphouët Boigny in Ivory Coast have initiated the study of the African species.

The objective is to have a reliable species database on the different organs of chickens in order to make it available to poultry farmers. The present article refers to the study of the reproductive system of the Gallus gallus hen initiated for the first time in Africa. Nevertheless, in the literature of existing works related to the female reproductive system of *Gallus gallus* are among others those of [23,24] who have worked mostly on the morphology and anatomy of the female reproductive system.

The present works relate to the histological study of the Ovary in order to highlight its structural organization.

II. Material And Methods

Biological material

The biological material is the *Gallus gallus* domesticus hen of the African breed "Dzaye". The study concerns adults aged at least 64 weeks. Sampling was done among retailers in the markets of Cocody, Bingerville, Abobo and Yopougon in the city of Abidjan and in some farms in Odienné in Côte d'Ivoire. On these markets and in these farms, the poultry are fed ad libitum with a feed consisting of corn bran mixed with pellets from the company IVOGRAIN.

Macroscopic method

The animals were photographed with a Lumix 12-pixel digital camera and a FUJIFILM 212-pixel digital camera. The observation of the reproductive system was done with the naked eye after dissection.

Anesthesia method

The highlighting of the reproductive system was carried out after dissection. For this purpose, the animals were anesthetized and euthanized. Anesthesia was performed by introducing the animals under an anesthesia bell containing cotton soaked in ether. After falling asleep, the animal was euthanized.

Method of dissection

For dissection, the animal was laid on its back and a longitudinal anteroposterior slit was made on the ventral side. The skin, muscles, and skeleton were successively removed to expose the internal organs. After opening, the first systems observed are the digestive system and the respiratory system. These last ones are separated in order to reveal the reproductive system, the object of our study. Once exposed the reproductive system was photographed in toto with a digital camera Lumix 12 pixels and another FUJIFILM 12 pixels. After photography, the Ovary was removed immediately and fixed in 10% formalin for histological studies.

Histological method

For the present works, the techniques used by[25] were used as reference. The ovary fragments, as soon as they were collected, were immediately fixed by immersion in 10% formalin. They were successively dehydrated in ethanol baths of increasing degree: 70°, 95° and absolute ethanol (100°). The parts are then pre-impregnated in baths consisting of the mixtures of 100° ethanol and toluene of increasing volume. The baths are successively ¼ toluene and ¾ of 100° ethanol, ½ toluene and ½ of 100° ethanol, ¾ toluene and ¼ of 100° ethanol. The last bath is pure toluene. Since toluene is not a holding bath, the parts were immediately pre-impregnated in liquid kerosene prepared for this purpose. The impregnation itself is done in the oven at 60°C in three successive baths of liquid kerosene (Paraplast brand: MONOJECT scientific). The embedding is done with the same medium. Sections of 7 µm were made with a MICROM HM 310 microtome. The sections were also collodionized (Collodion 4%, Merk) to avoid their detachment. The slides resulting from these treatments were stained with hemalun and eosin. The observation and the photographs were made with an OLYMPUS CKX 41 photomicroscope adapted to a DELL computer with the optica software.

III. Results

General morphology of the *Gallus gallus* domesticus hen and its reproductive system before fixation

The hens of African breed "Dzaye have an entirely white plumage (Figure 1) with a reproductive system in the form of an ovarian cluster (Figure 2).

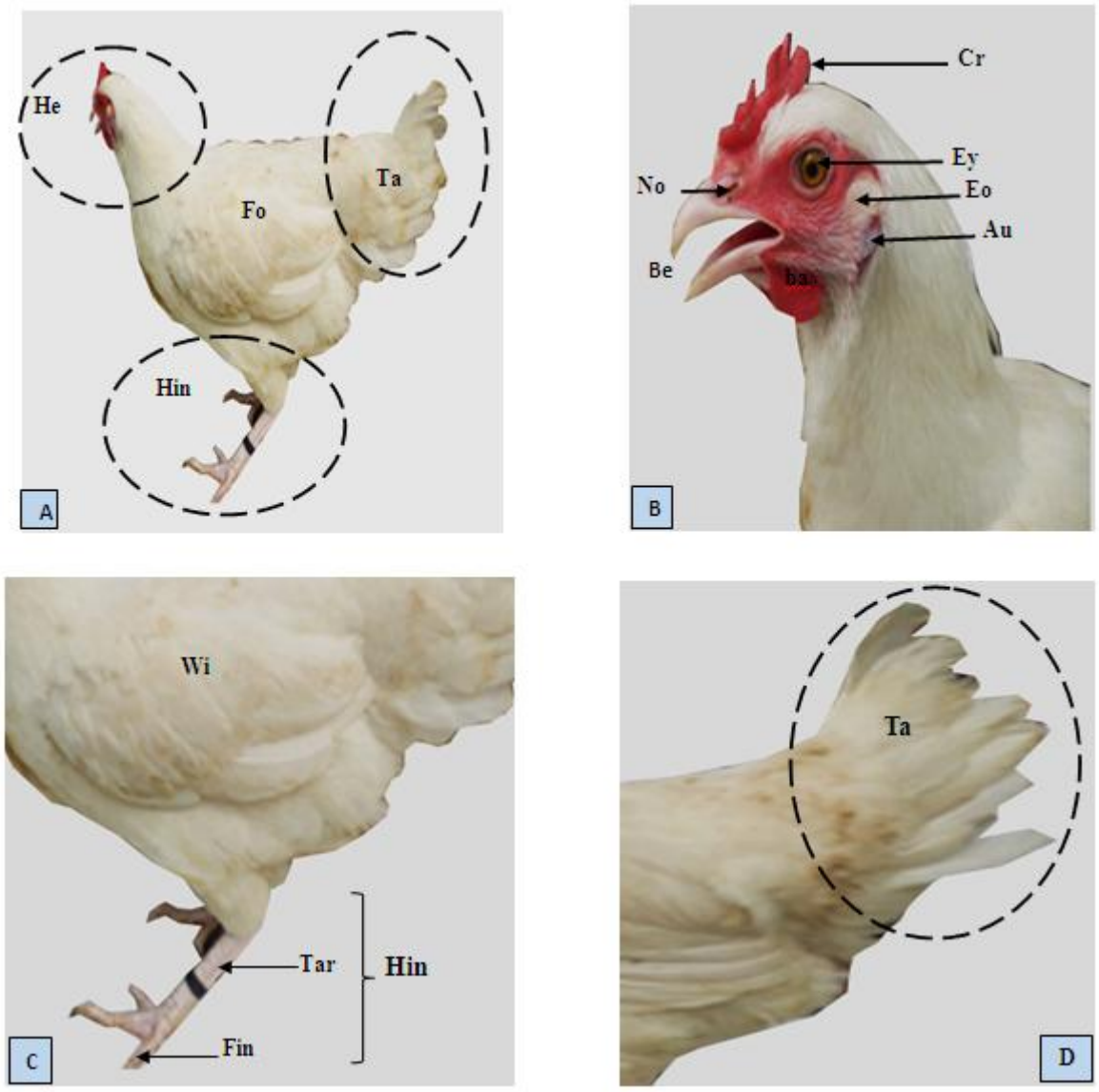

Figure 1: Morphology of the chicken Gallus gallus domesticus

A: General morphology; B: Morphology of the head; C: Morphology of the hind legs; D: Morphology of the tail
He: head; Cr: crest; Be: beak; No: nostrils; Ey: eye; ba: barb; Eo: ear opening; Au: auricle; Ta: tail; For: forelimbs;
Wi: wing; Hin: hindlimbs; Tar: tarsus; Fin: fingers; Dew: dewclaw.
Magnification: G x 1/5

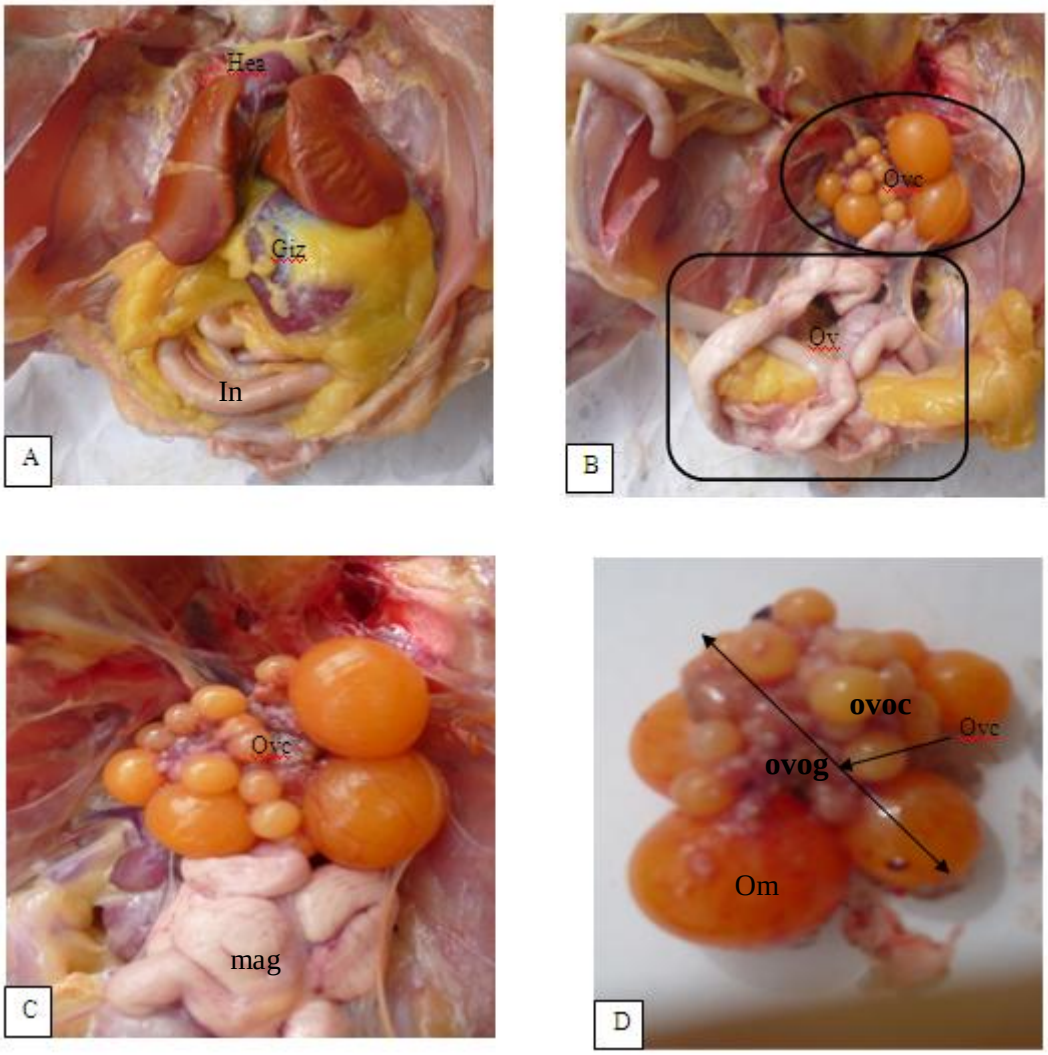

Figure 2: Internal anatomy of the hen with the reproductive system

A: Thoracic cage of the hen after dissection; B, C: Reproductive system in toto; D: Isolated ovarian cluster.
Hea: Heart; Li: Liver; Giz: Gizzard; In: Intestine; Ovc: ovarian cluster; Ooc: oocytes; ovog: ovogonia;
me: mature egg; mag: magnum; Ov: oviducte
Magnification: A, B: G x 1/10; C, D: G x 1/5

Histology of the ovary

Referring to the literature, no work dealing with the structure of the Ovary of Birds exists at histological level. Due to the lack of scientific support in this field, the histological examination of the Ovary of the *Gallus gallus* hen has been carried out in relation to the histology of the Ovary of Mammals.

Thus, after histological treatment and microscopic observation, the hen's ovary is an organ with very irregular contours. It includes two main areas, the cortical area and the medullary area richly vascularized.

The cortex which contains several follicles at different stages of maturation (figure 3A).

Microscopic observation shows that the follicle consists of a wall about 400µm thick, a cytoplasm loaded with vitellus and a nucleus (Figure 3B).

The wall of this follicle consists of several layers from the outside to the inside:

A thin layer of connective tissue topped by collagen fibers about 3/4 the thickness of the wall; of smooth muscle tissue. Above the smooth muscle is a space and rounded cells. In addition, a thin membrane separates the cells from the small vitelline inclusions with a large nucleus (Figure 3C). This wall represents the envelope of the yolk. This yolk, also called vitellus, consists of several round vesicles. The size of these vesicles decreases as one approaches the center. (Figure 3D)

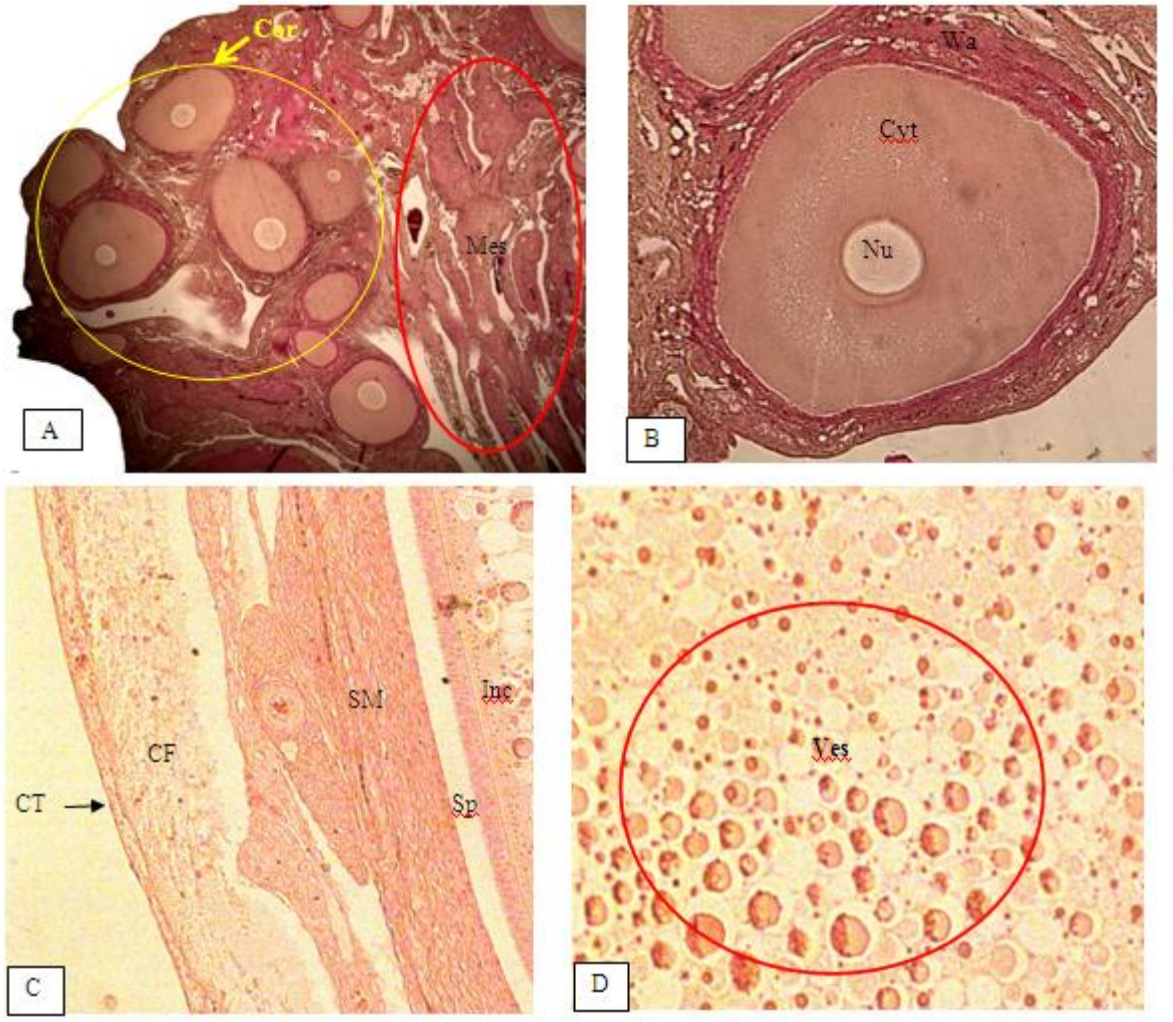

Figure 3: Histology of the reproductive system of the hen *Gallus gallus*
A: Follicle after fixation; B: General view of the follicle after observation under the light microscope
C: detailed view of the membrane layers of a follicle; D: detailed view of the yolk of a follicle
Cor: cortex; Med: medulla; Wa: wall; Cyt: cytoplasm; Nu: nucleus; CT: connective tissue; CF: collagen fiber; SM: smooth muscle; J: yolk; Sp: space; Inc: inclusion; Ves: vesicles; Wa: wall.
Staining: hemalun-eosin; Magnification: A: G x 1/2; B: G x 40; C, D: G x 100

IV. Discussion

The description of the organization of the avian Ovary structure described for the first time is based on the observation of this structure in Mammals.
Ovaries are the female gonads that are odd in Birds and even in Mammals[26].
On the histological level, unlike the Ovary of Mammals which is a full organ[27], the bird ovary (hen) is a hollow organ. In addition, the Ovary of birds, like that of mammals, as shown by[28] is made up of two zones, namely the medullary zone and the cortical zone. The medullary zone in birds as in mammals is richly vascularized[29]. As for the cortical zone, it houses the cortical stroma, interstitial cells and ovarian follicles. This organization of the cortical zone in the Ovary of Birds is identical to that of Mammals described by[30,31]. Indeed the avian cortical stroma is poorly organized: it contains numerous blood and lymphatic capillaries as well as steroid-secreting interstitial cells. These interstitial cells are characterized by a spongy cytoplasm. This organization of the avian cortical stroma corroborates that of mammals described by[32]. The avian cortical stroma also harbors numerous eosinophilic polymorphonuclear cells. As for avian ovarian follicles, they are different from those of Mammals by an enormous oocyte growth following an important vitellus load. Another difference, the avian follicles are full and non-cavity[33,34]. The follicular cells remain throughout vitellogenesis arranged in a monolayer all around the oocyte. These avian ovarian follicles differ in size in different parts of the ovary. The youngest and smallest are usually placed in the center of the ovary, while the oldest and largest have moved to the periphery of the ovary. Their increase in size is mainly due to the accumulation of yolk in the oocyte and less to the increase and differentiation of the follicular layer and surrounding cells. This distribution of follicles in the Bird Ovary is

similar to that described by[35] in Mammals. Furthermore, the sexual cell (follicle) of the bird's ovary is made up of several membrane layers from the inside to the outside, such as: a thin layer of connective tissue; collagen fibers; smooth muscle and inclusions. This constitution of the ovarian follicle in birds is different from that of mammals as shown by[32]. Thus, all this organization of the reproductive system of birds in particular the ovary, corroborates the work of [36,37].

V. Conclusion

On the histological level, the ovary of the Dzaye Gallus gallus hen consists of a cortex housing the ovarian follicles and a richly vascularized medullary. The ovarian follicles of the hen are characterized by an enormous oocyte growth due to an important yolk load. These follicles are full and non-cavity. They have a very thick wall with several cell layers and a yolk-laden cytoplasm that represents the yolk of the egg. This description seems to be made for the first time as no reference is made by the literature**.**

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