J. KAU: Mar. Sci., vol. 7, Special Issue: Symp. on Red Sea Mar. Environ., Jeddah, 1994, pp. 215-232 (1416 A.H. / 1996 A.D.)

Histological Studies of the Developing Gonads of Redspot Emperor *Lethrinus lentjan* (Lacépède), (Pisces, Lethrinidae) from Jeddah Waters of the Red Sea

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ABSTRACT. The cyclic changes in the structure of the gonads of Redspot emperor *Lethrinus lentjan* (Family: Lethrinidae), from Jeddah waters of the Red sea, were studied. A description of six developmental stages of both oocytes and spermatocytes maturation is given. Mode of reproduction, fine structure and dimensions of sexual cells and the developmental stages during the process of maturation during oogensis or spermatogensis are shown. Ovarian development was found to be asynchronous, with more than a single clutch of oocytes being matured in the same spawning season. Many atretic follicles are distinguishable during the different maturity stages. Histological examination of the gonads also gave evidence for protogynous hermaphroditism among the species studied.

Introduction

Lethrinids or emperors (Family, Lethrinidae) are widespread in both tropical and temperate seas (Fischer and Blanchi, 1983). They are important components of many fisheries in various countries. In Saudi Arabia, they form a considerable catch from both Red sea and Arabian gulf and are recently planned to be raised by Aquaculture. Redspot emperor or *Lethrinus lentjan* (Lacépède) is a widely distributed and economically important fish. Despite the commercial importance and abundance of the species there are few publications describing their biology in the area (Kedidi, 1984; Kedidi *et al.*, 1984; Wassef, 1991 & Wassef *et al.*, 1991). The aim of the present study was to examine maturation and associated histological changes of the gonads over an annual reproductive cycle. Besides, it investigates the phenomenon of hermaphroditism frequently observed by the authors, and by other earlier workers as well. Previous reports on the subject, for other regions, are those of Toor (1962), for Indian waters; Loubens (1980) for New Caledonian waters; Young and Martin (1982) for Australian waters; El Dossary (1986) for El Dammam waters (Saudi Arabia); and El Agamy *et al.* (1987) for Qatari waters, of the Arabian gulf.

Material and Methods

Lethrinus lentjan samples were obtained fresh from the commercial fishery of Jeddah waters of the Red sea landed at "Bangalah" center. They are locally known as "shaour" and are mainly taken, with other lethrinids, by hooks and lines and beach seines. Collection extended for a whole year, from December 1988 to November 1989, usually at monthly (sometimes biweekly) intervals. Gonads were macroscopically staged using a 6-stage scale, according to their morphological appearance as previously given by Wassef and Bawazeer (1992). Total fish length ranged from 16-41.5 cm.

More than 100 gonads (ovaries and testes), cover different stages of maturity were fixed in either Bouin's or Zenker's fixative, dehydrated in an ethanol series and embedded in paraffin. Tissue was sectioned at about 6 μm and stained with haematoxylin and eosin (H & E). Samples were sectioned at the proximal, medial and distal parts of each gonad and the best sections were considered. Measurements were taken on sections with the aid of an ocular micrometer.

Terminology used for description of the different stages of oocyte growth follows that of Yamamoto

(1956) and Guraya *et al.* (1975) reviewed by West (1990).

Results

In most studies, ovaries are classified by the most advanced maturation stage of oocytes present, without consideration of how numerous they are. A staging scheme based on abundance rather than proportions (*i.e.* relative numbers of the different types of oocytes) is to be preferred and it was adopted in the present work. Photomicrographs of sections of gonads of *L. lentjan* showed a developmental pattern which can be classified into six stages (after Guraya *et al.*, 1975 & West, 1990). The histological features at each of these stages are described below as follows :

Ovaries

Stage I: Resting stage (Chromatin nucleolar stage)

Ovary has a thick muscular wall (16.7-83.3 μ) consisting of two layers of circular muscle separated by a thin layer of longitudinal muscle (Fig. 1b). Some testicular tissue can also be seen within the ovarian wall (Fig. 3a).

Numerous ovigerous folds bud off inwards forming nests of oogonia and oocytes that fill the ovarian lumen and separated by connective tissue (stroma) (Fig. 1a). In addition to the developing oogonia attached to these folds some atretic follicles (remaining from the previous spawning season and usually referred as brown bodies) are also distinguishable (Fig. 2). An oogonium is a small, thin-walled, round cell (diam. 15.4-39.0 μ), commonly exists in groups and possesses a large nucleus which stains uniformly. The nucleus contains a single large nucleolus (Fig. 1c). Oogonia are dominant in the ovaries at maturity stages I, II & III.

Concomitant with oogonium development, the nucleus increases in size and multiple nucleoli appear at its periphery at the end of this stage. The resulting pre-perinucleolar oocytes begin to appear in some ovaries.

Stage II: Early maturation stage (Perinucleolar stage)

Ovarian wall still relatively thick (58.1-124 μ). Ovigerous lamellae are readily identifiable. Ovary contains oocytes at different stages of maturity in addition to the oogonial masses along the nests of oogonia. These oocytes can be classified into three generations as follows :

1. Pre-perinucleolar oocytes : These cells are larger in size (diam. 39.6-50.8 μ) than the oogonia and have thick-wall (11-19.8 μ). Nucleus (diam. 2.2-13.2 μ) has a marked, dark chromatin ring and contains single large nucleolus. The cytoplasm is a homogeneous, undifferentiated, thin layer surrounding the nucleus (Fig. 2).

2. Early perinucleolar oocytes: Larger in size (diam. 48.4-4-66 μ) than the previous type, and has a bigger nucleus with multiple smaller nucleoli at its periphery. Densely stained cytoplasmic granules start to appear.

3. Late perinucleolar oocytes: Characterized by their largest size (diam. 59.4-110 μ). Nucleoli (diam. 2.2-6.6 μ) still have their peripheral position. Chromatin material also observable inside the nucleus (Fig. 3b). The outer follicular epithelial layer surrounding the oocyte become comparatively thinner than the preceding type.

Stages I & II represent the protoplasmic growth of oocytes.

Stage III: Maturation stage (Yolk vesicle, Cortical alveoli formation)

This stage, and those following it represent the trophoplasmic growth. The process of yolk deposition begins and consequently the oocytes increase in size. The cytoplasm become generally heterogenous and two concentric zones are noticeable: an outer pale and an inner dark (Fig. 3a & b). The nucleus is circular and contains the small nucleoli surrounding its wall. Oogonia and pre-perinucleolar oocytes are still present. Yolk nucleus also appear in some oocytes (Fig. 3d). Ovary wall reduced in thickness (42-105 μ). According to the stage of yolk deposition, oocytes are divided to two types as follows :

A. Primary yolk vesicle oocytes: (Fig. 3b): When yolk granules start to deposit they acquire a dark colouration and hence, two concentric zones of yolk vesicles are noticed, those adjacent to the nucleus are generally of bigger sizes than those at the periphery. Oocyte diameter varies between 107.9 & 190.9 μ, nucleus 58.1 & 91.3 μ, nucleoli 2.2 & 4.2 μ and yolk vesicles 8.3 & 16.6 μ. Thickness of oocyte wall (chorion) is about 4.2-6.2 μ.

B. Secondary yolk vesicle oocytes: (Fig. 3b & c): Yolk vesicles increased in size and number and fill most of the cytoplasm. Oil droplets or lipid vacuoles are also appeared (Fig. 3c). Oocyte increased greatly in size (diam. 249-375 μ). Nucleus (diam. 41.5-47.7 μ) is clear and nucleoli still keeping their peripheral position. The cytoplasm become condensed with yolk and oil spheres (Fig. 3d). Zona radiata (4.2-8.8 μ) can be

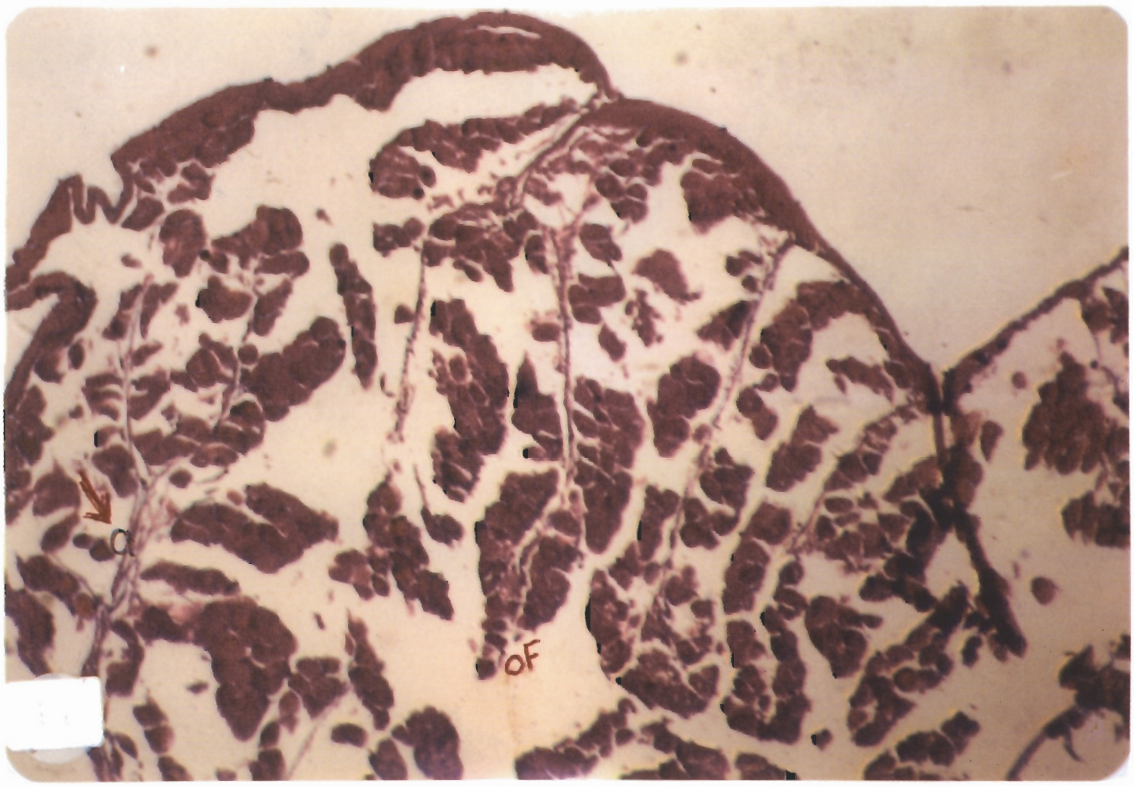

FIG. 1a. *Resting stage* – (26.5 cm, January). Cross section of ovary showing the ovigerous folds (OF) and connective tissue (CT) or stroma (E.H) (× 60).

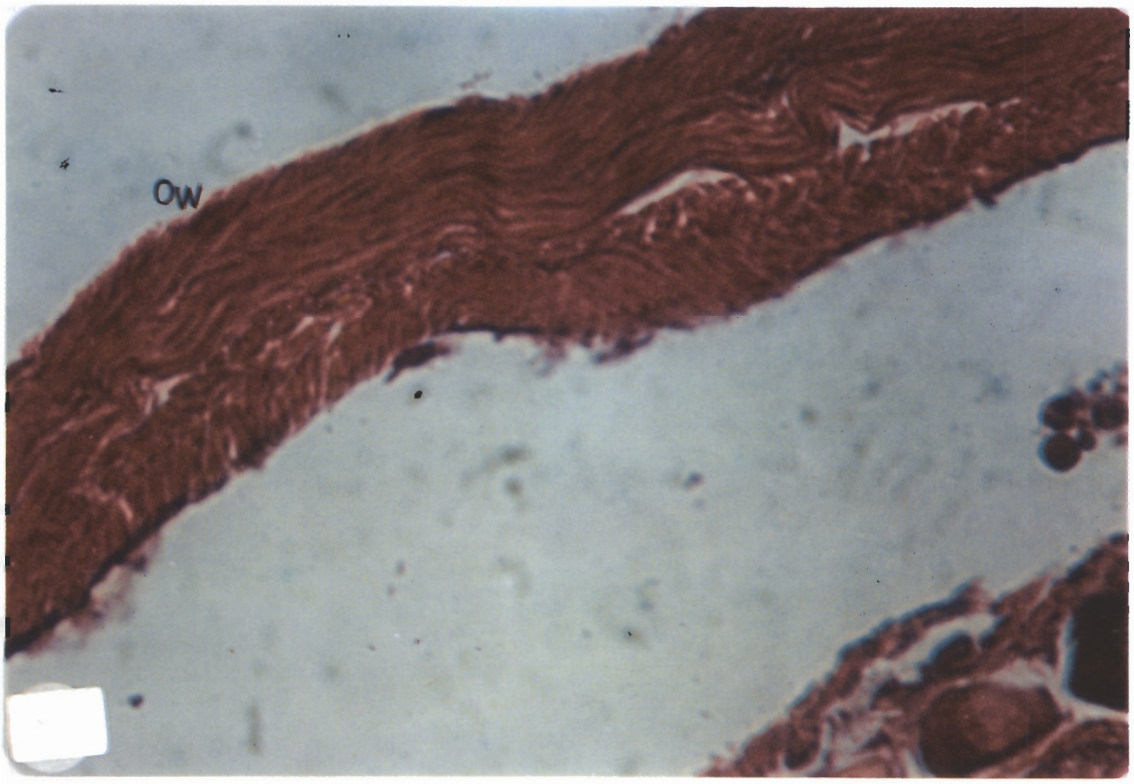

FIG. 1b. Part of the ovarian wall (OW) showing two layers of circular muscle separated by one layer of longitudinal muscle. (E.H) (× 375).

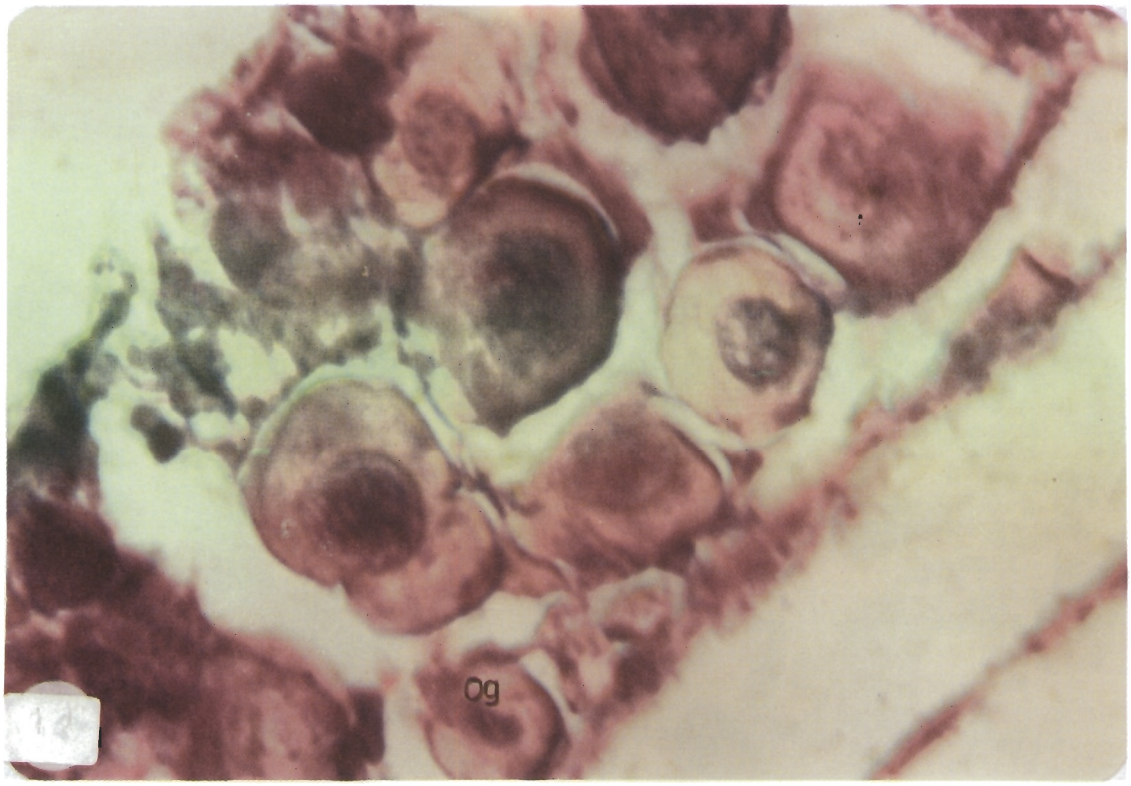

FIG. 1c. Magnified part from a nest of oogonia showing dividing oocytes (Og). (E.H) (× 600).

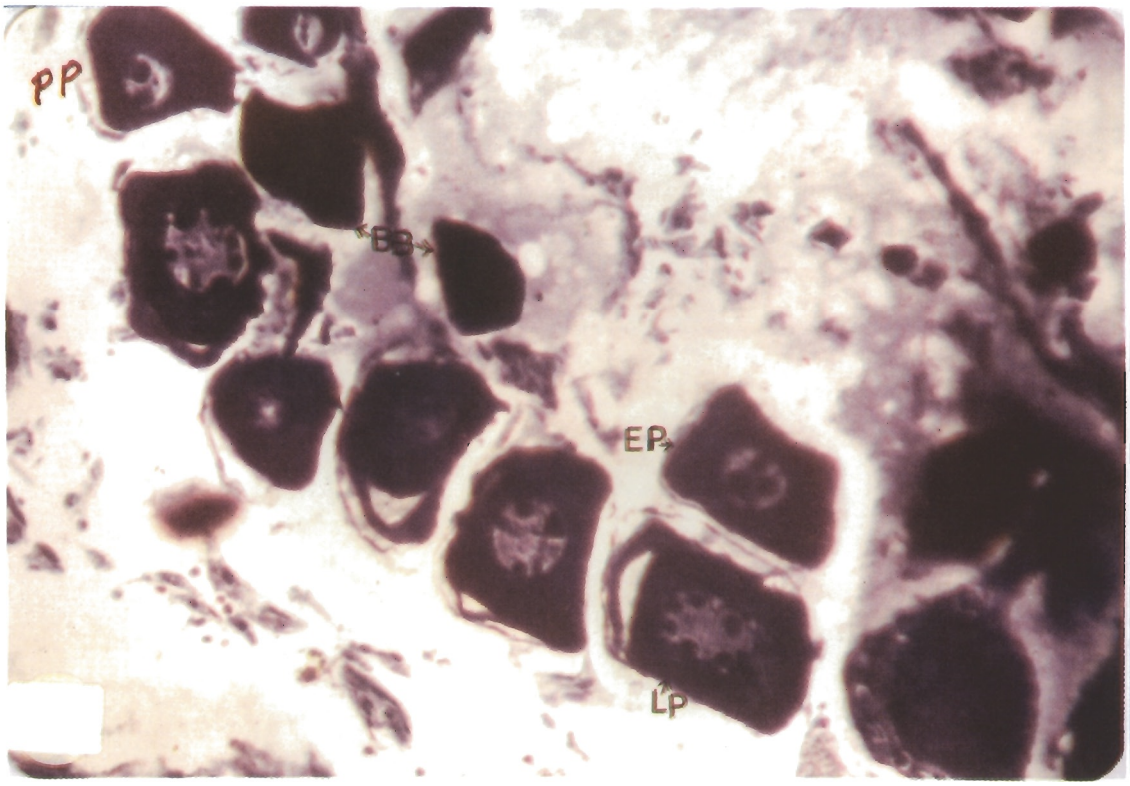

FIG. 2. *Early maturational stage* – (28.3 cm, February). Section of ovary showing pre-perinucleolar (PP), early perinucleolar (EP) and late perinucleolar (LP) oocytes and brown bodies (BB). (E.H) (× 375).

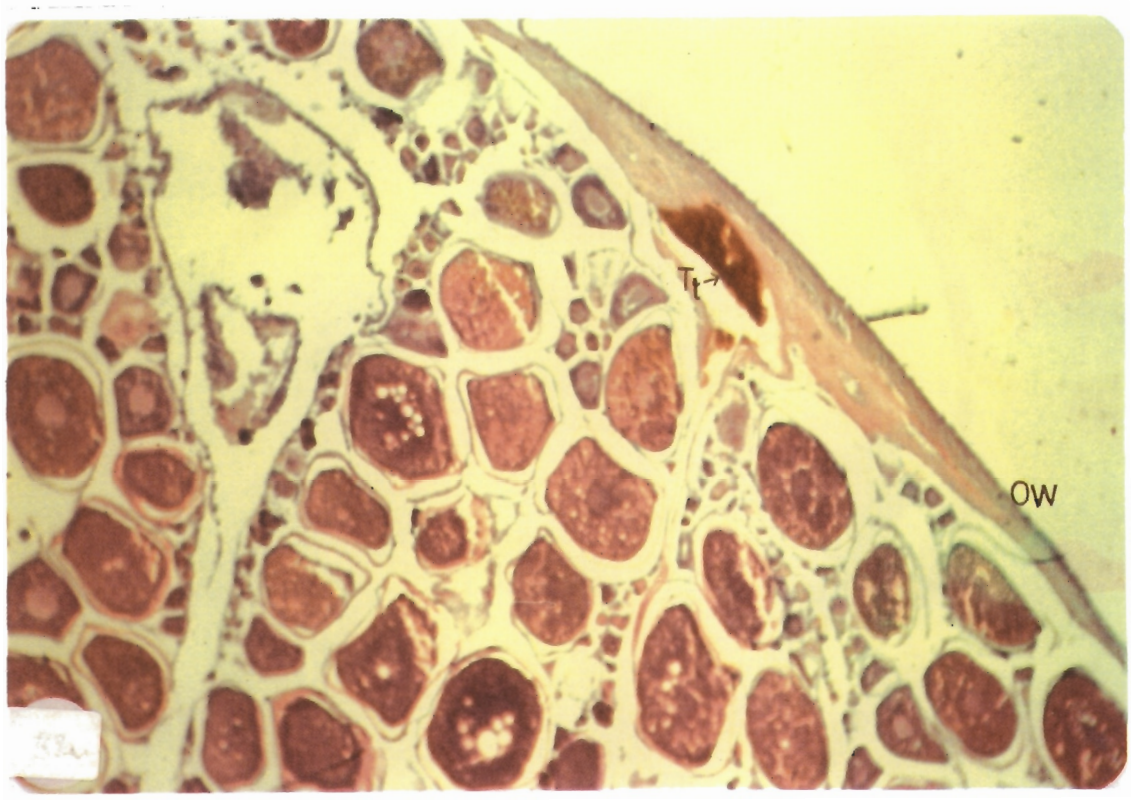

FIG. 3a. *Maturation stage* – (29 cm, March). Oocytes (Oo) at different stages of development and testis tissue (Tt) within the ovarian wall (OW). (E.H) (× 60).

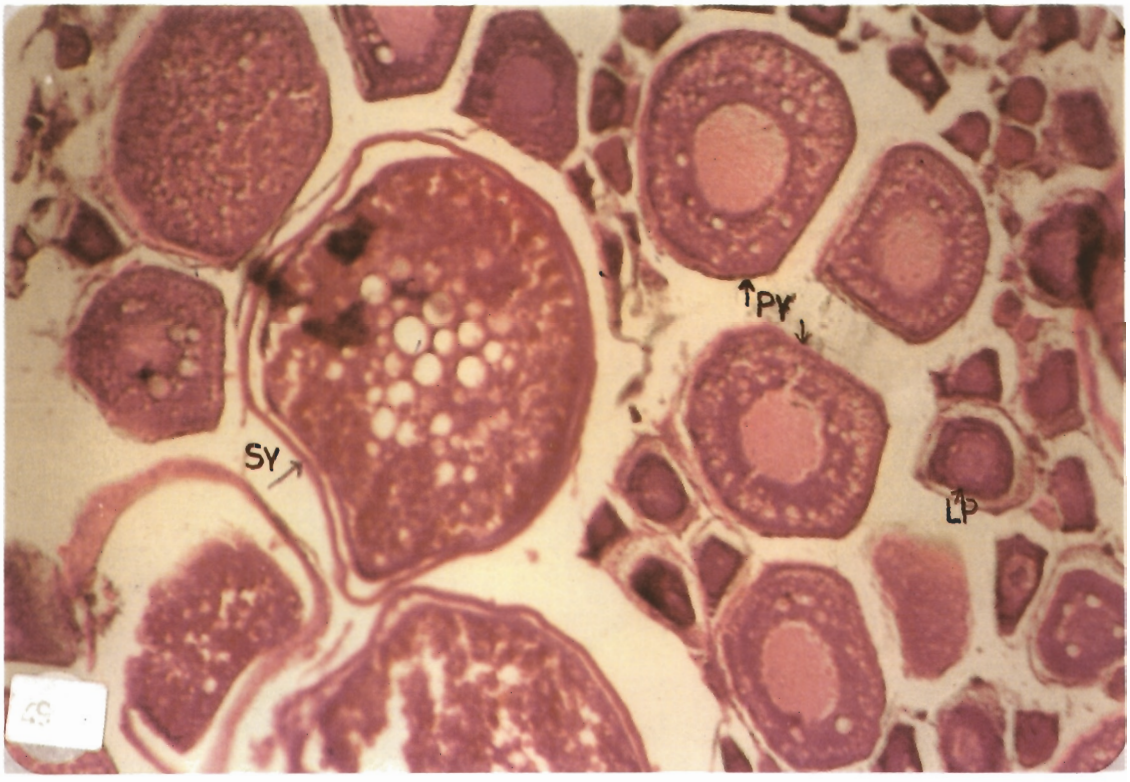

FIG. 3b. Magnified part of the previous section showing oocytes at different stages of yolk deposition. Primary yolk vesicle oocyte (PY), late secondary yolk vesicle oocyte (CY) and late perinucleolar oocyte (LP). (E.H) (× 150).

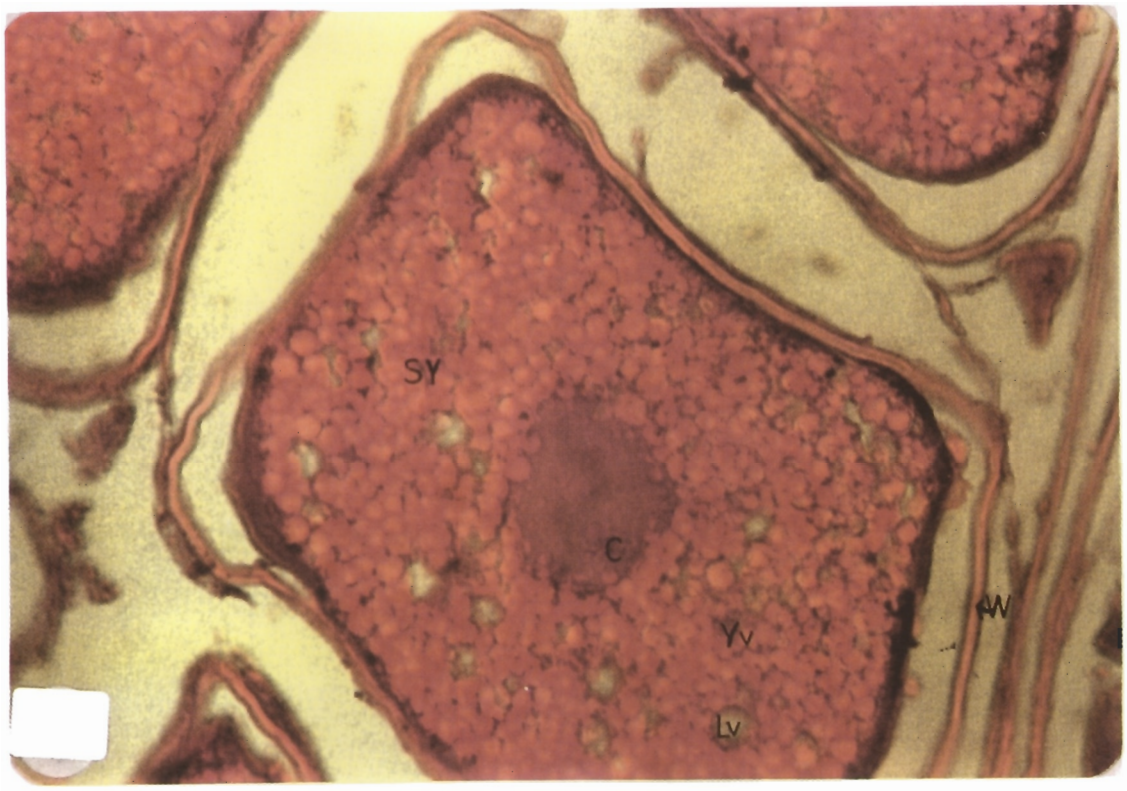

FIG. 3c. Magnified secondary oocyte (SY) filled with yolk vesicles (Yv) and showing lipid vacuoles (Lv), chromosomes near nuclear membrane (C) and well developed ovum-wall (W). (E.H) (× 375).

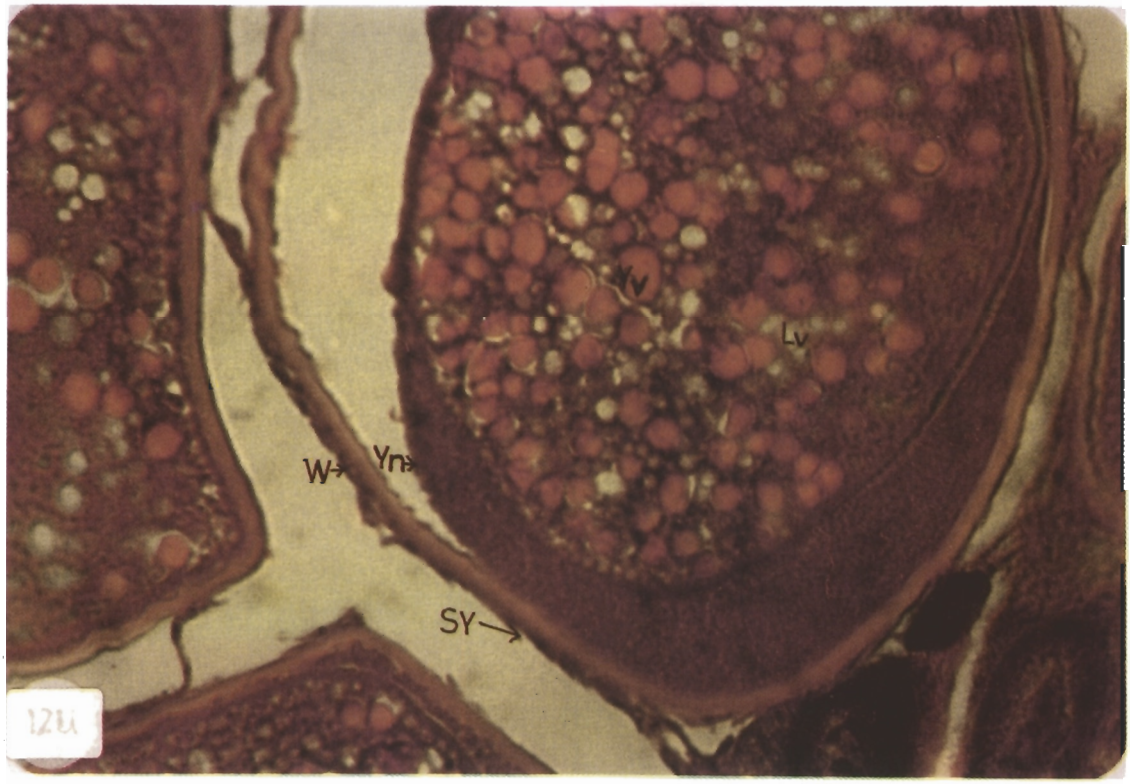

FIG. 3d. Highly magnified late secondary oocyte (SY) showing yolk vesicles (Yv), lipid vacuoles (Lv), yolk nucleus (Yn) and ovum-wall (w). (E.H) (× 600).

easily seen in the oocyte wall, and is surrounded by a follicular epithelium layer (Fig. 3d). Coalescence of yolk and oil spheres starts in some oocytes. Plenty of atretic oocytes are also detected at this stage, which are defined either previtellogenic or vitellogenic atretic oocytes.

Stage IV: Ripe (Prespawning) stage

This stage characterized by the first appearance of yolk liquifaction, the nucleus looses its circular shape and the dissolution of nuclear membrane in some oocytes become clear (Fig. 4a). Migration of the nucleus towards the animal pole takes place (Fig. 4b). Chorion decreases in thickness (2.7-4.2 μ), and can be identified to three layers which, from outside, are: follicular epithelia, zona radiata and zona granulosa respectively (Fig. 4c). Ripe ova (diam. 307-415 μ) acquire their characteristic transparency (Fig. 5). The ovarian wall reduced greatly in thickness (25-41 μ).

Stage V: Running (spawning) stage

Most of ova are at complete yolk liquifaction, hence, become more transparent (Fig. 5). The final stage of oocyte development is reached. Ovum wall become very thin (3.7-4.0 μ), but its three layers are still recognizable.

When ovulation takes place, follicular membranes rupture leading to the release of ripe ova into the ovarian lumen for spawning. Ovary wall decreased greatly in thickness (24.9-33.2 μ). At this stage gentle press on the abdominal region of fish releases ova from the genital aperture.

Stage VI: Spent (postspawning) stage

Spawning (ovulation) resulted in ruptured, empty or postovulatory follicles, which are prevailing (Fig. 6). Atretic follicles as well as oocytes at different yolk deposition stages are still present. Ovarian wall becomes relatively thick again (41.5-66.4 μ).

Two types of atretic oocytes (Fig. 7) are identifiable.

a) – Pre-vitellogenic atretic oocytes: signalled by homogenous cytoplasm, absence of yolk granules and the presence of a single big, conspicuous, thick-walled nucleus. This type of atresia appear to take place during the early developmental stages of maturation, *i.e.* appeared as disintegrated late perinucleolar oocytes.

b) – Vitellogenic atretic oocytes: characterized by the presence of several cytoplasmic yolk granules, irregular cell wall and folded chorion due the increased number of follicular epithelial cells surrounding the

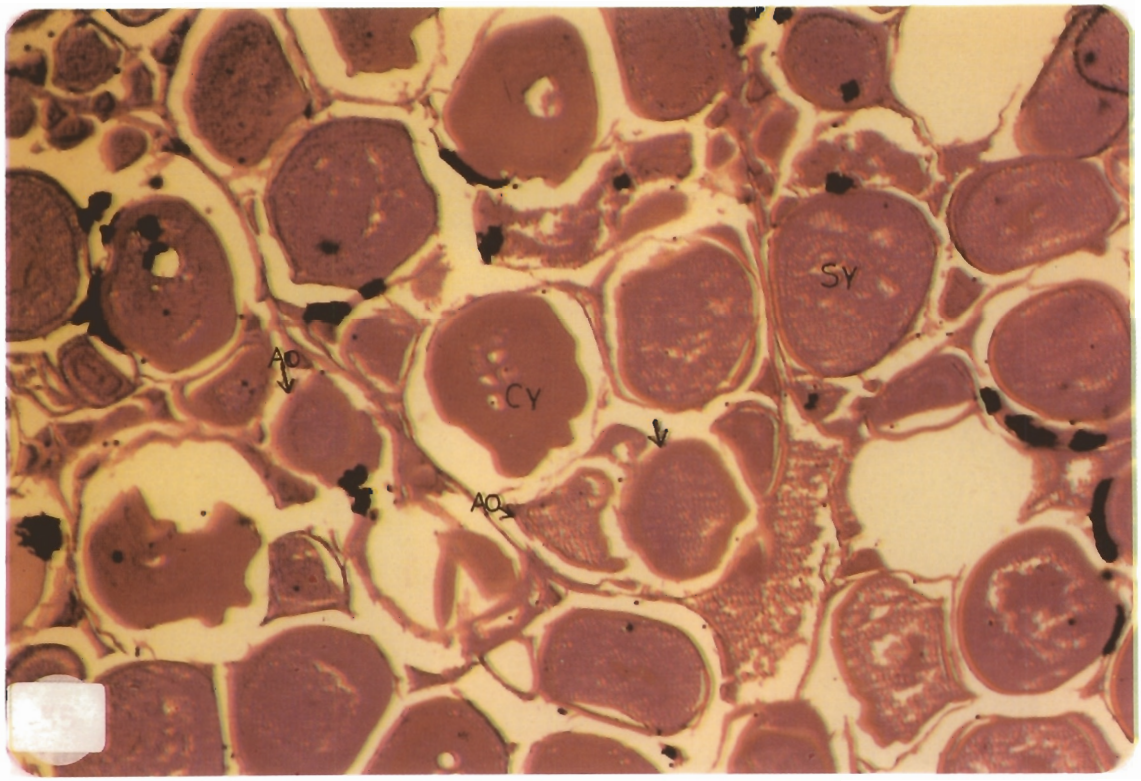

FIG. 4a. *Pre-spawning stage* (28.5 cm, March): Section showing liquid-yolk (LY) within coalesced secondary oocytes (CY) and some atretic oocytes (Ao). (E.H) (× 60).

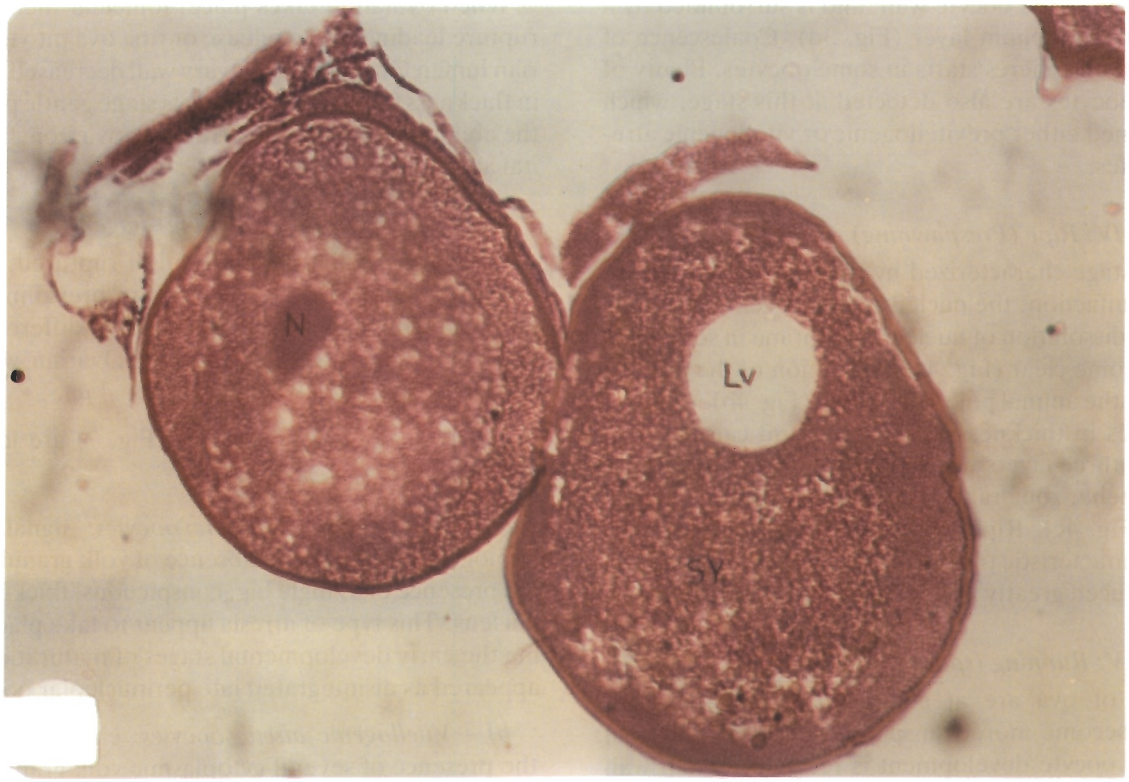

FIG. 4b. Late secondary oocyte (SY) showing yolk liquifaction, nucleus (N) migration, lipid vacuoles (Lv) and well developed ovum-wall (w). (E.H) (× 350).

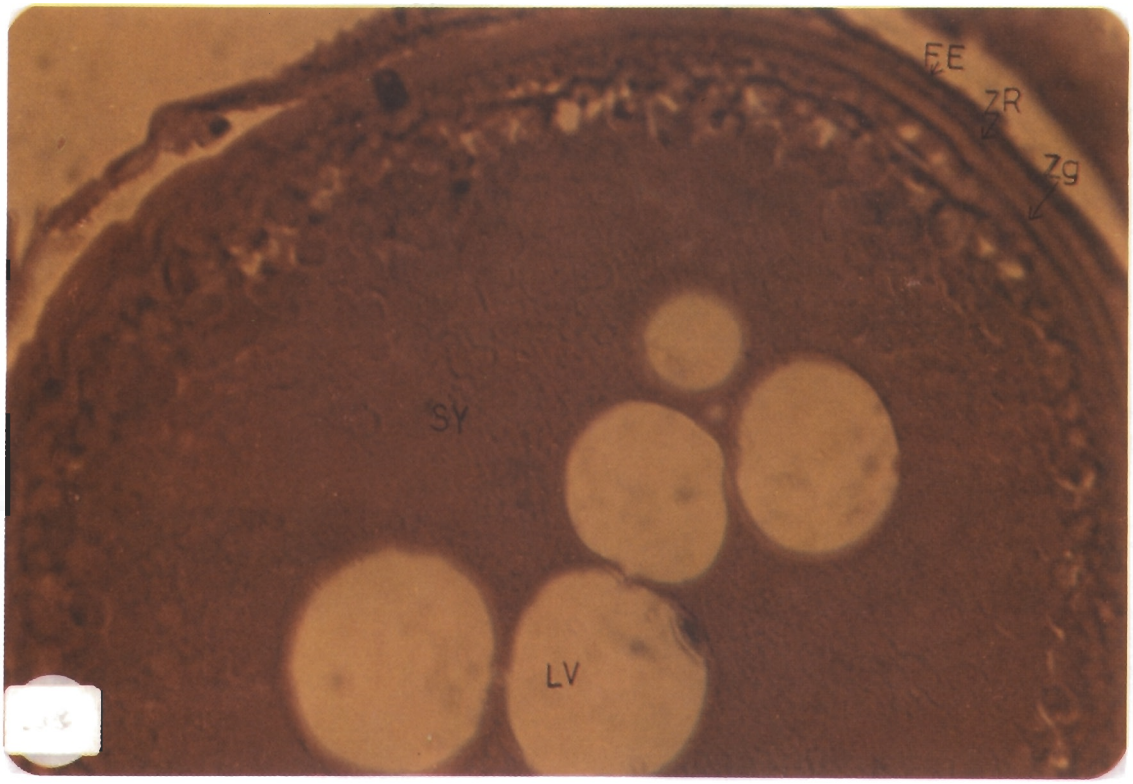

FIG. 4c. Higher magnification of the previous section illustrates the three layers of ovum-wall: follicular epithelium (FE), zona radiata (ZR) and zona granulosa (ZG). (E.H) (× 600).

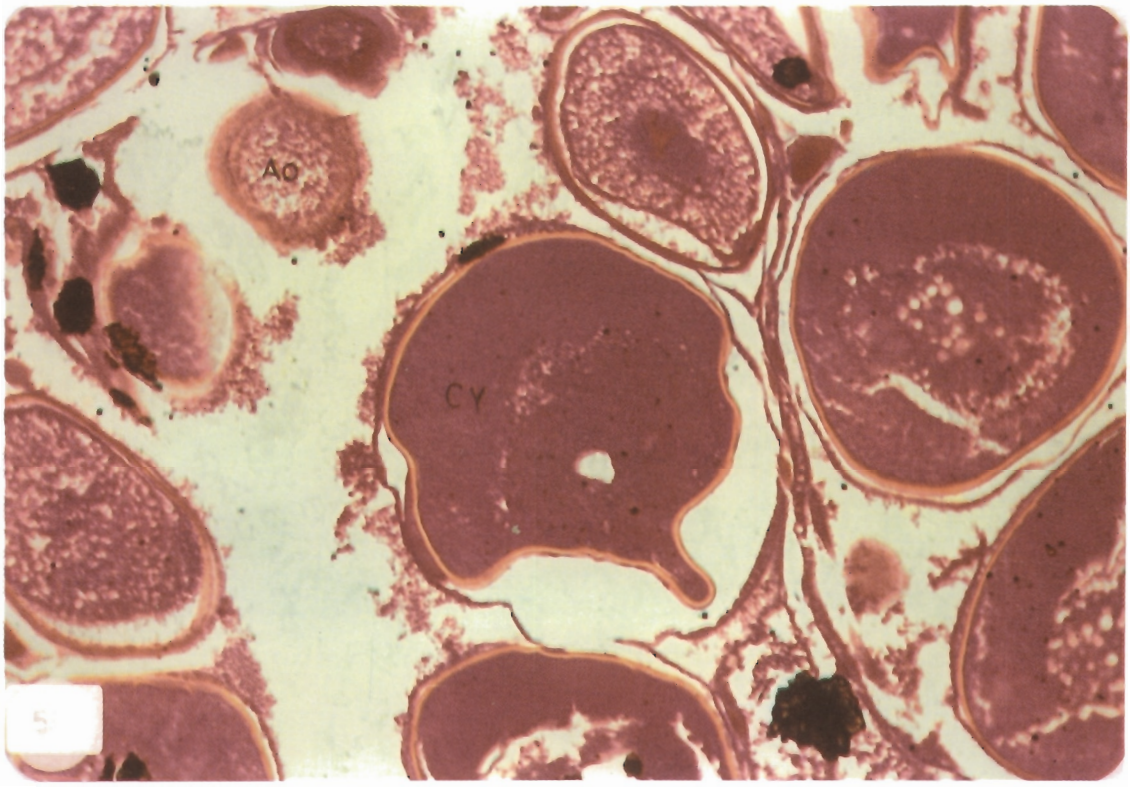

FIG. 5. *Spawning stage* (29 cm, April): Coalesced secondary yolk oocyte (CY) or ripe ovum and atretic oocytes (AO). (E.H) (× 150).

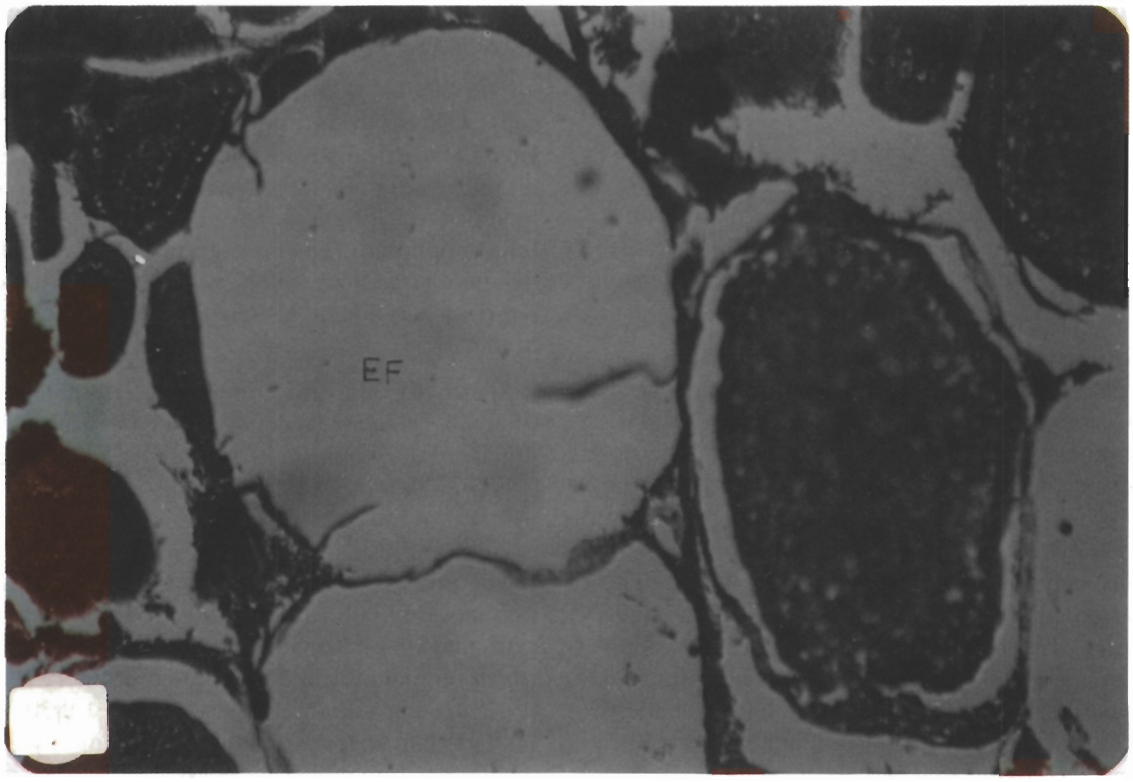

FIG. 6. *Post-spawning stage* (29.5 cm, June): Empty follicles (EF). (E.H) (× 150).

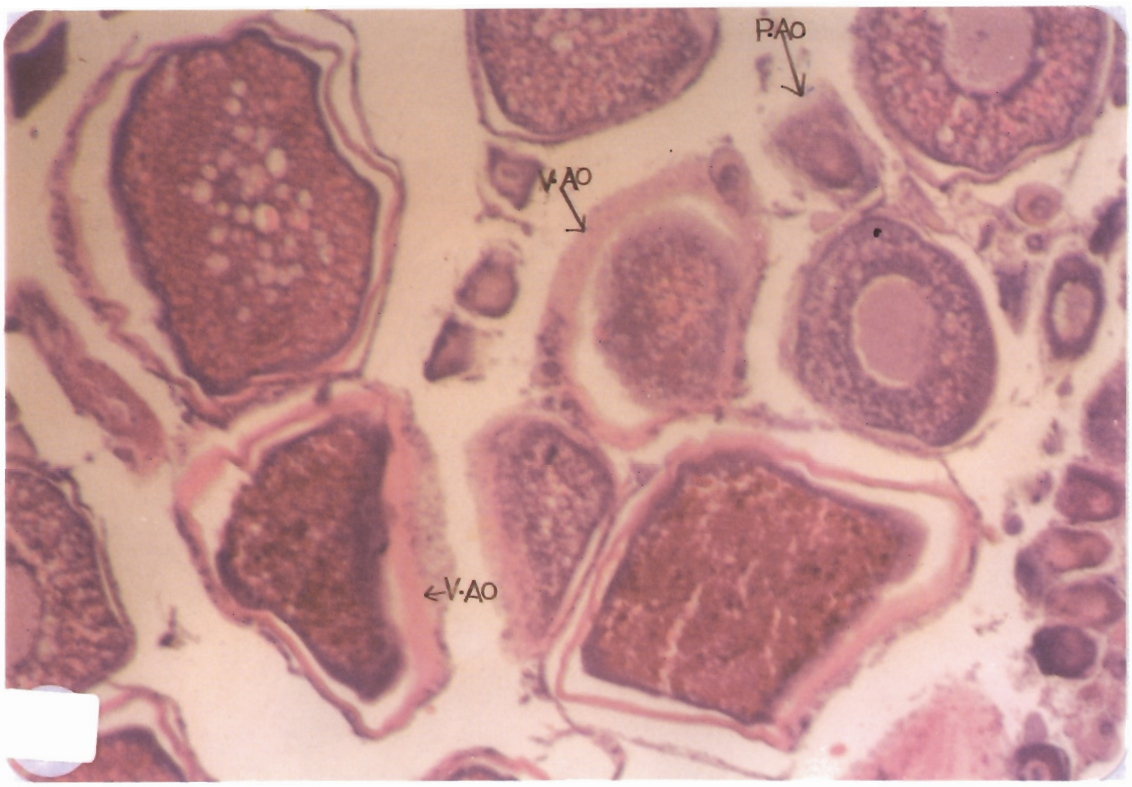

Fig. 7. *Maturation stage* (29 cm, March): Pre-vitellogenic atretic oocytes (P Ao) and vitellogenic atretic oocytes (V AO). (E.H) (× 150).

oocyte. This type is the most frequent and constitutes about 10% of atretic oocytes' total number.

Testes

Stage I: Resting stage

As *L. lentjan* is a protogynous hermaphrodite, primary males haven't been detected among the sections available. Here stage I in the male is a reversed female.

The testis consists of ovigerous folds filled with male germ cells. These resemble much the female germ cells. Atretic oocytes occur in the section as dark brown bodies which are largely basophilic. Micrographs of the representative sections showed that the testis of *L. lentjan* is of the radial type and, as in most teleosts, attached to a mesorchium and composed of numerous convoluted seminepherous lobules. The width of lumenial lobules varies in relation to the stage of maturity. Testicular wall or tunica propria (33.2-41.5 μ) composed of two layers: the external attached to the mesorchium in a way that it can hardly be identified. The internal layer (tunica albumena) is a fibrous connective tissue that largely borders the testis. The rostral lobules of the testis contain round germ cells and spermatogonia which are either present individually or grouped within the sperm cysts (Fig. 8).

The lobular wall is lined with a layer of epithelial cells, whereas the interlobular spaces consist largely of vacuolated stroma cells and contain Leydig cells and blood vessels (Fig. 8). Spermatogonia are located along the lobule's periphery and stain light (chromophobic). The male germ cells are identifiable by their large size (diam. 8.1-10.1 μ), with central large nucleus and highly chromophobic nuclear membrane.

Spermatogonia are comparatively smaller in size (diam. 4.1-8.0 μ), darker in colour and each contains a thin layer of cytoplasm surrounding a single large nucleus (Fig. 9a).

Stage II: Early maturation stage

The process of spermatogenesis starts at this stage. Lobules are filled with primary, secondary spermatocytes and spermatogonia in addition to the germ cells which remain attached to lobules periphery (Fig. 9a). It seems that spermatocytes (diam. 1.9-3.6 μ) are smaller than spermatogonia and commonly grouped together within a spermatocyst. Neither the nucleoli nor the cell membrane are clearly detectable. The

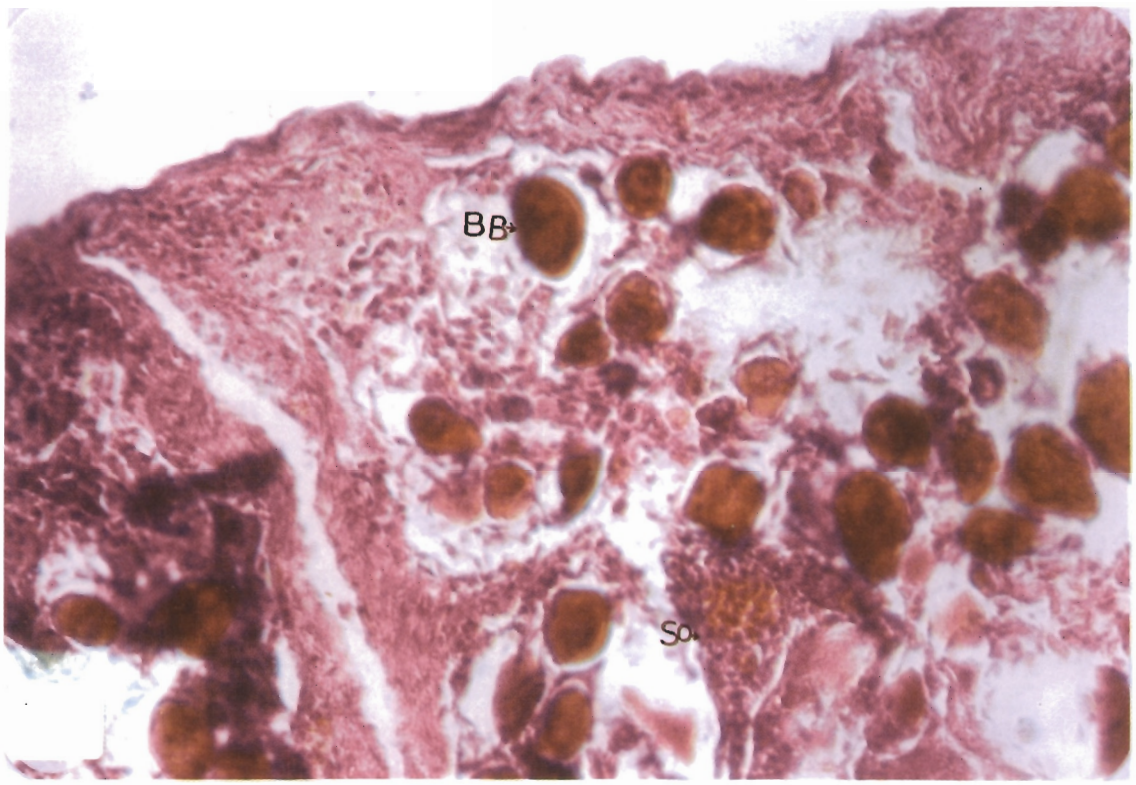

FIG. 8. *Rest stage* (27 cm, January): T.S section in testis showing spermatocytes (SO) as well as brown bodies (BB) or ova within the testis. (E.H) (× 375).

chromatin material is concentrated at one pole of the nucleus (Fig. 9a).

The smallest cells appear at this stage are the secondary spermatocytes (diam. 0.9-1.8 μ) that appear densely stained (Fig. 9b).

Stage III: Maturation stage

Spermatogenesis, becomes more active with high degree of synchronization. Spermatocysts are filled with primary, secondary spermatocytes and spermatids (diam. 0.63-0.90 μ), in addition to the spermatogonia, which keep their peripheral position. Spermatids are shown at the periphery of the testis near the sperm duct (Fig. 10a & b). The thickness of testicular wall varies between 16.6 & 24.9 μ.

Stage IV: Ripe (Pre-spawning) stage

The process of spermiogenesis begins. Spermatids are transformed to spermatozoa (sperms), which fill the lobules' lumen (Fig. 11 & 12). The presence of large numbers of sperms characterizes this stage. A sperm (Fig. 12) appear as a dark circle (nucleus or sperm head) attached to a fine thread (sperm tail). The wall of testis reduced greatly in thickness (8.2-16.6 μ).

By the end of this stage, only few primary and secondary spermatocytes are still present and various nests of spermatids are spread within the sperm lobules. Germ cells and spermatogonia are also present but in fewer numbers.

Stave V: Running (spawning) stage

It seems that the process of spermatogenesis has completely ended at this stage. Lobules are swollen and densely packed with spermatozoa, consequently they loose their general shape. Lobular walls become very thin (3.8 μ). Very few primary and secondary spermatocytes are still present. The discharge of sperms during spawning can be detected by the decrease in spermatozoa numbers and the reduction of sperm lobules' width (Fig. 12).

Stage VI: Spent (postspawning)

Testis has emptied most of its content and several cavities appear in cross sections (Fig. 13). Lobular wall contracted, becoming thicker and wrinkled. The lobules are distorted and some remains of undischarged spermatozoa are still present in both lobules and duct. Testicular wall also become relatively thicker (16.6-41.5 μ). Some residual nests of sper-

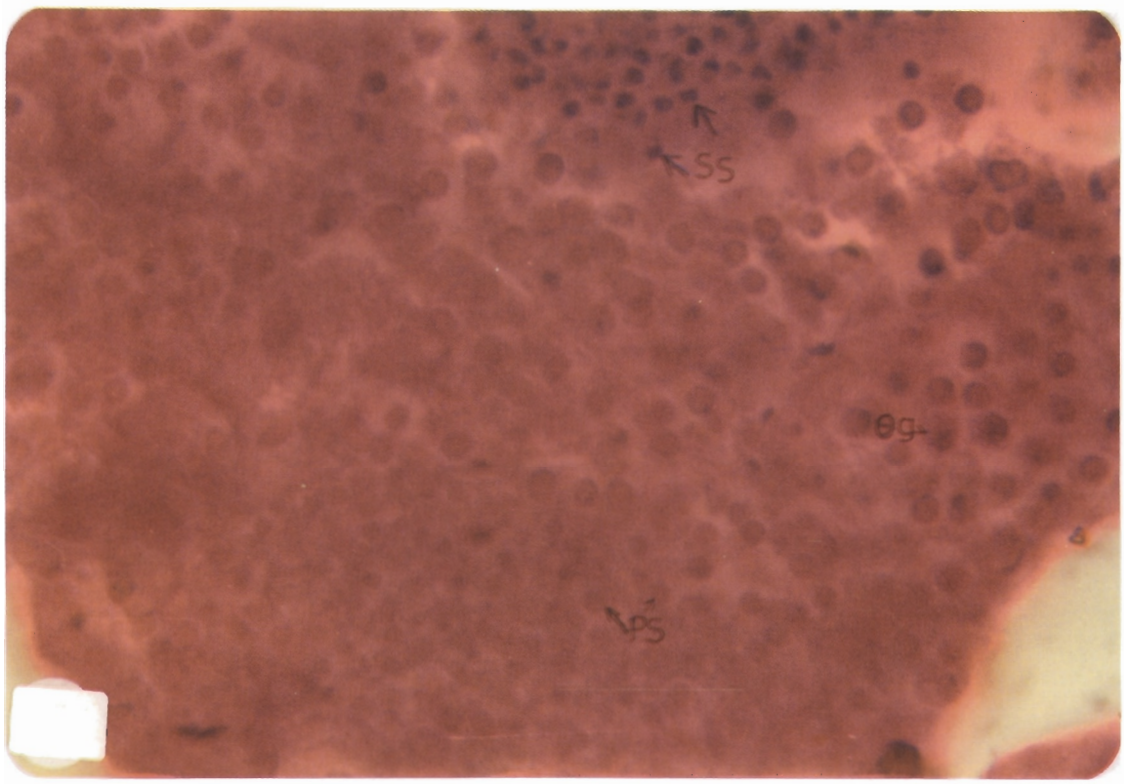

FIG. 9a. *Early maturation stage* (25.5 cm, February): Spermatogonia (Sg), Primary spermatocytes (PS) and secondary spermatocytes (SS). (E.H) (× 500).

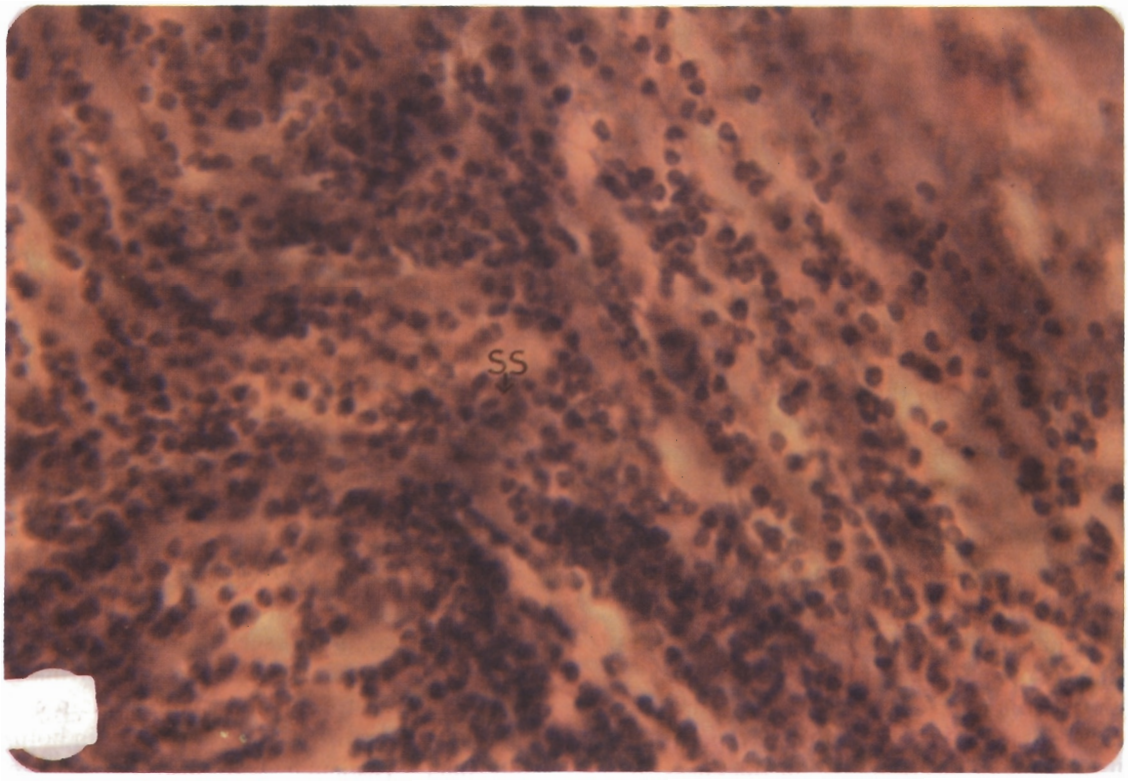

FIG. 9b. Highly magnified secondary spermatocytes (SS), from the previous section. (E.H) (× 600).

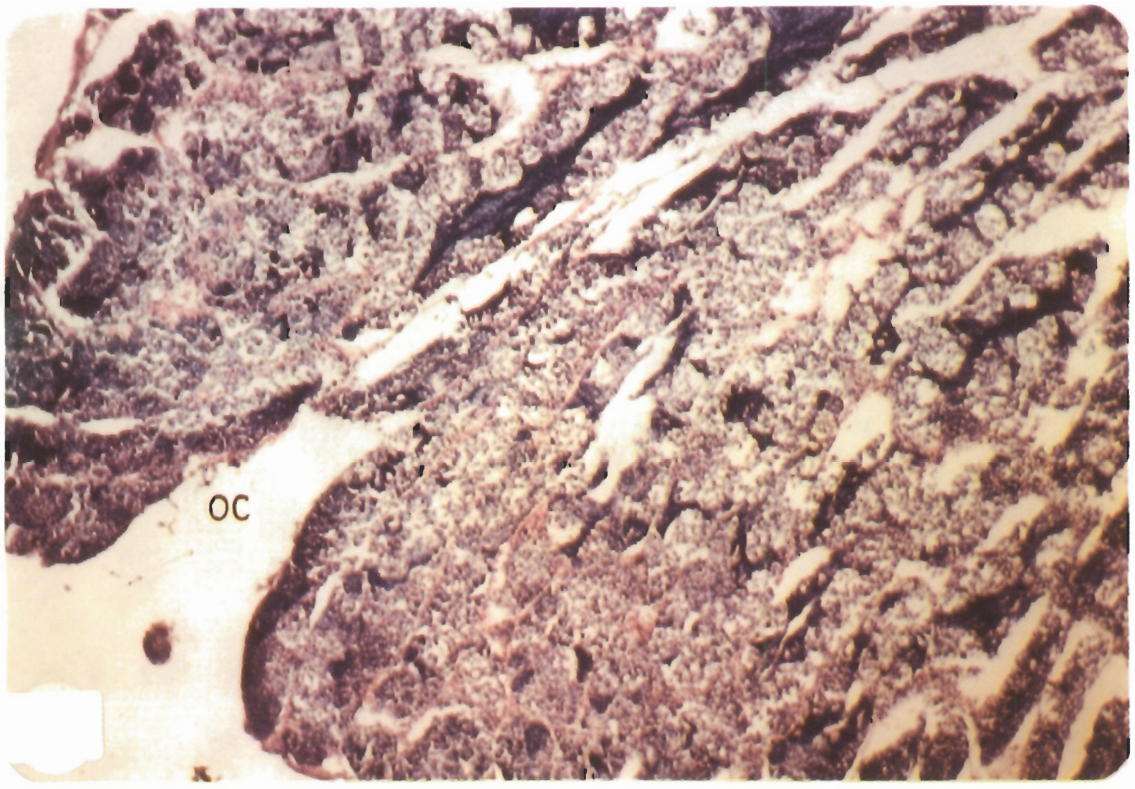

FIG. 10a. *Maturation stage* (26.3 cm, March): Ovarian cavity (OC) within the testis (E.H) (× 60).

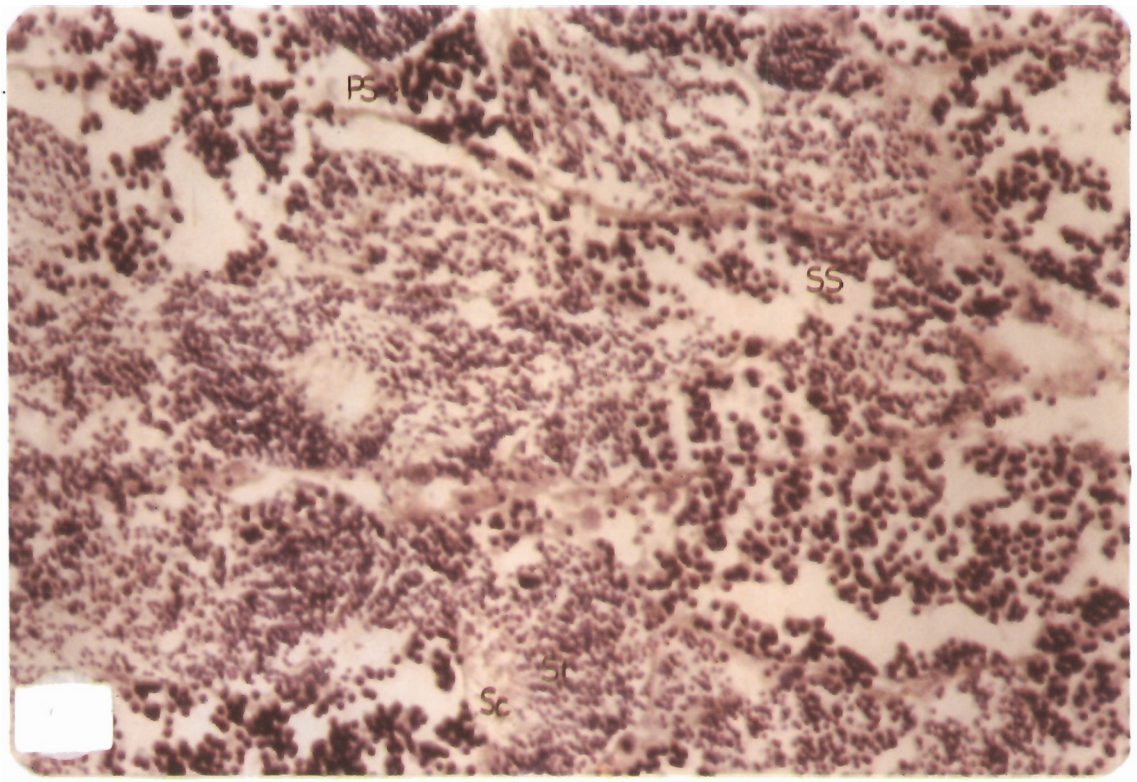

FIG. 10b. Magnified part from the previous section shows primary and secondary spermatocytes (PS) & (SS) respectively, spermatids (St) and sertolli cells (Sc). (E.H) (× 375).

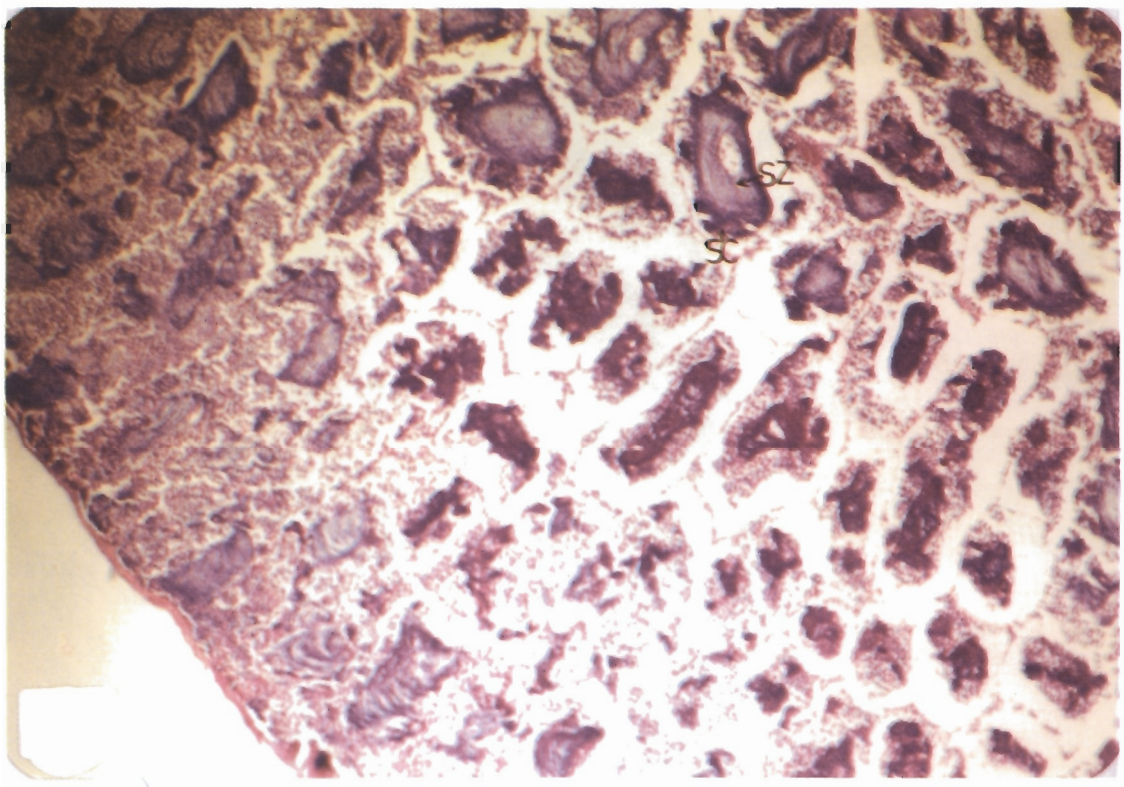

FIG. 11. *Pre-spawning stage* (31.8 cm, March): Spermatocyst (SC) loaded with spermatozoa (Sz). (E.H) (× 60).

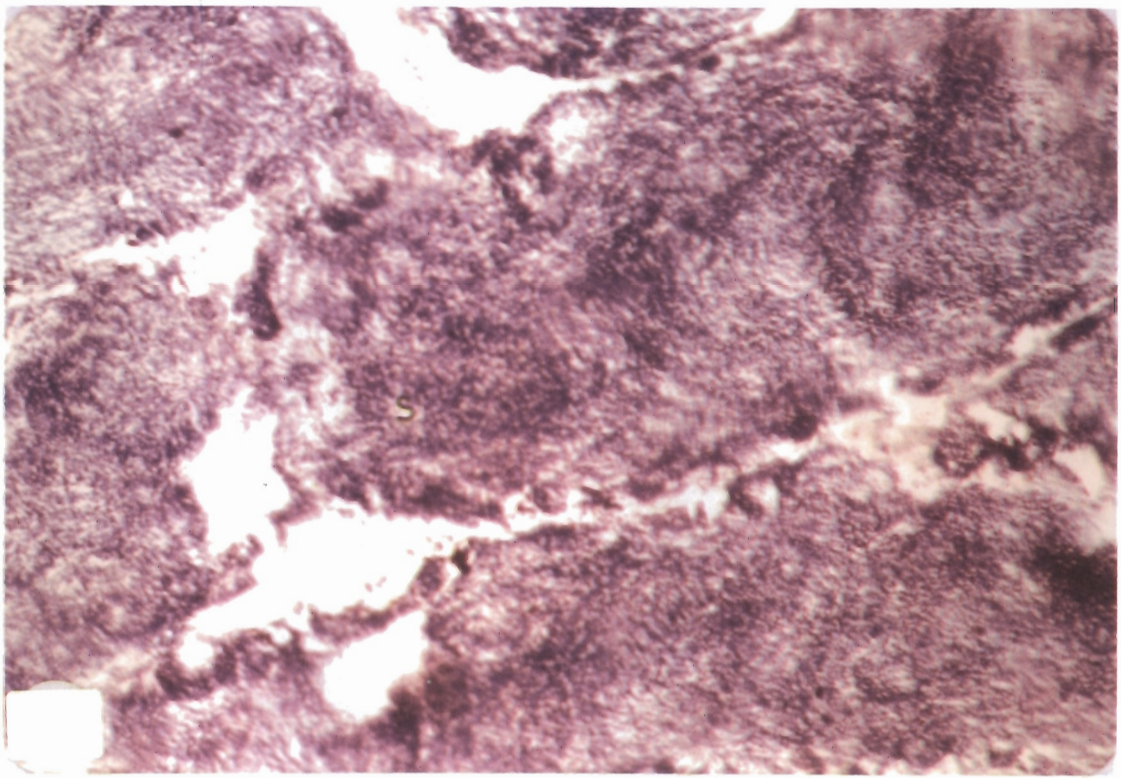

FIG. 12. *Spawning stage* (31.0 cm, April): Testis full of sperms (S). (E.H) (× 150).

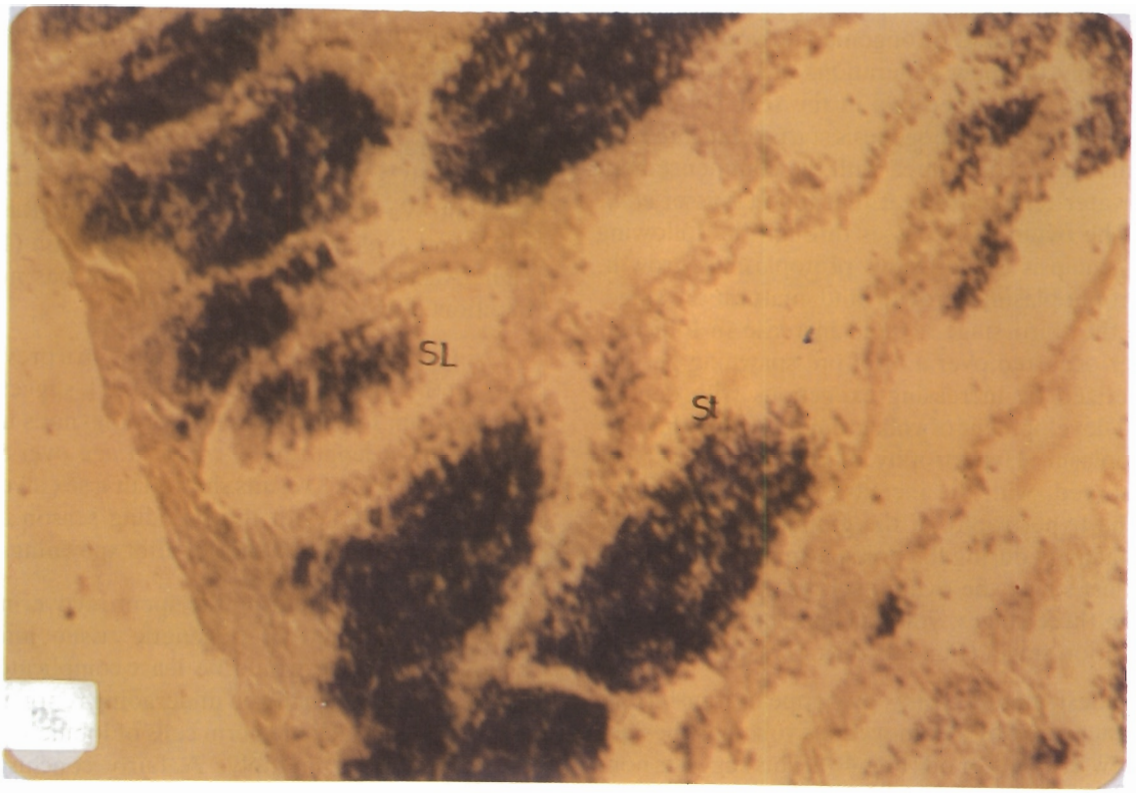

FIG. 13. *Post-spawning stage* (29 cm, May): Seminiferous lobules (SL) reduced in size due to the release of sperms. Some spermatids (St) are shown near lobule's wall. (H.E) (× 375).

matocytes are shown at the periphery of many lobules (Fig. 13).

Discussion

The external features of the different gonadal maturity stages have been described for *Lethrinus mahsena* in an earlier work of the authors (Wassef and Bawazeer, 1992), and are also given for *L. lentjan* by El Agamy *et al.* (1987). In the present study, histological investigation of both ovaries and testes has shown some characteristics of both oocytes and spermatocytes during their developmental growth stages. Individual variations in the rate of oogenesis or spermatogenesis process are noticed among fishes examined. So that, we can find more than one maturity stage of the gonad in one fish sample collected from the same place at the same time. Moreover, oocytes vary greatly in size, staining affinity and nucleoli characteristics whereby different generations of developing, maturing and ultimately ripening ova could be assorted. This suggests *L. lentjan* ovaries to be classified as "asynchronous" type, according to Wallace and Selman's system (1981). DeValmig (1983) considered that most species with asynchronous oocyte development have protracted spawning season with multiple spawning with the female spawning several times in a breeding season. These fishes also referred to as "partial", "fractional", "multiple" or "serial" spawners (Holden and Raitt, 1974 & Macer, 1974) implying that only part of the complement of yolked oocytes is spawned and that individuals spawn over a protracted period. Breeding period of *L. lentjan* in Jeddah waters was previously determined to extend for about four months, from April to July (Wassef *et al.* 1991). Burt *et al.* (1988) associate multiple spawning within years with less-seasonal environments, the case prevailing in Jeddah waters of the Red sea where temperature variations never exceeds 10°C. The same spawning season was also reported by El Dossary (1987) and El Agamy *et al.* (1987) for the species of the Arabian gulf.

The observed pattern of ovarian and follicular growth in female *L. lentjan* was similar to that previously described generally for other teleost species (Wallace and Selman, 1981; DeValmig, 1983; Guraya, 1968; Wallace *et al.* 1987) and reviewed by West (1990). The first contributions in the subject for lethrinids were those of Salem (1971 & 1976) for *L. nebulosus*, *L. mahsena* and *L. variegatus* respectively.

For *L. lentjan*, ova developed from the follicular germ cells (in the ovary) and also from stocked

oogonia (from the previous spawning period). Ovaries always contain a fund of oogonia and young oocytes which supply the new generations of oocytes to replace for the discharged ova in the sexually mature females. The proces of oogenesis starts off in late February, may be accompanied with the commencement rise in water temperature at that time (Wassef *et al.* 1991). The ovum itself passes through the following stages: synapsis stage, slow protoplasmic growth, rapid trophoplasmic growth and maturation stage. During the third stage a rapid increase in follicular diameter occurred over a brief pre-spawning period, characterized by increasing exogenous yolk deposition and development of yolk granules within the oocyte cytoplasm. Hypertrophy of the granulosa layer was observed, with the increase in the size of these cells. The hypertrophy of the granulosa suggests increased activity during the pre-spawning period. During the last stage, the ovum itself passes through the following three stages: yolk nucleus stages 1 & 2 and vacuolization stage. (Fig. 3d, 4b & c, respectively).

The oldest mature yolky ova appear translucent, and characterized by a homogenous yolk mass besides one or few droplets of oil (Fig. 4b). This suggests non-massed (after Yamamoto, 1956), pelagic eggs for red-spot emperor.

With the stained materials used, maximum diameter of ripe ova was 415 μm in a 29 cm female. Whereas, El Agamy *et al.* (1987) recorded a range of ripe ova diameter of 700-1000 μ for the species in Qatari waters. On the other hand, Toor (1986) recognized seven maturity stages in the process of oogenesis and suggested two spawning seasons for the species inhabiting Manar Bay of the Indian waters.

Our observations, are similar to those given by El Dossary (1987) and El Agamy *et al.* (1987) for the species in Arabian gulf, except that the latter authors have used different terminology, than used herein, for the different maturity stages.

On the other hand, male *L. lentjan* exhibit a discontinuous cycle of germ cell development, with a prolonged resting phase from August to October and from December to February. Spermatogenesis begins in March, a month later than oogenesis, proceeds so that some testes become distended with sperms in April along May/July period. The presence of males having testes loaded with sperms (in advance) prior and during the spawning season and additional waves of spermatogenesis along the whole duration of this season are in adaptation to be discharged for pelagic eggs and the rather long breeding period of the females. This, combined with the earlier commencement of oogenesis, suggested a relatively faster growth rate of spermatogenesis than oogenesis in the species under study.

The phenomenon of hermaphroditism has been frequently noticed among lethrinids by many authors (Salem, 1971 & 1976; Loubens, 1980; El Dossary, 1987 and Wassef *et al.* 1991 and Wassef and Bawazeer, 1992) and evidenced by Young and Martin (1982) in eight Australian species. Although, it has not been mentioned by El Agamy *et al.* (1987).

Using the sex ratio/size or age data, in a previous report on the species (Wassef *et al.* 1991), suggested sex change from females to males (protogynous hermaphroditism) at length of 33 cm or at age over 5 years. The present work's results showed that sex inversion is intimately linked with the breeding season and the transition is completed shortly after spawning.

It is likely to be during the spent-recovering stage that reorganization of oogenetic tissue into spermatogenetic tissue would be least complicated. The ovaries would normally be undergoing reorganization as lobules contract and germ cells of lobule wall's and interstisial areas multiply. A fairly conclusive evidence for sex transformation could be taken from the following observations, shown in cross-sections herein, as follows :

1 – The occurrence of testicular and ovarian tissues in the same gonad (Fig. 3a, 1c & 8).

2 – The presence of a central cavity (residual oviduct) within the testis (Fig. 10a).

3 – The torsion of ovarian wall inwards to form the future sperm duct (Fig. 10a).

4 – The presence of 'amorphous' brown bodies (atretic ovarian follicular material) at resting stages for male individuals (Fig. 8).

In the present work, the presence of small-sized male fish (less than 25 cm) indicate the presence of 'primary' or true males within the population examined, in addition to the typical secondary males (derived from post-spawned females). The existence of primary males was not detected by Young and Martin (1982) perhaps because the male fishes they sampled were all over 26 cm long.

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دراسات نسيجية على تطور مناسل أسماك الشعور كريسيت القاطنة مياه جدة - المملكة العربية السعودية - من البحر الأحمر

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المستخلص: تعتبر أسماك الشعور من الأسماك ذات الأهمية الاقتصادية والقيمة التسويقية العالية في المملكة العربية السعودية حيث تمثل حوالي ١٩٪، ٢٤٪ من المصيد التجاري بالبحر الأحمر والخليج العربي للمملكة على التوالي (حسب تقرير مركز أبحاث الثروة السمكية بجدة عام ١٩٨٧م). لذا فإن لدراسة بيولوجية التكاثر لهذه الأسماك أهمية كبرى حيث تمد المسئولين عن حماية الثروة المائية بالمعلومات الأساسية اللازمة لتنمية المصيد. وقد تتبعت الدراسة النسيجية الحالية لمناسل الأسماك كل من عمليات تكوين البويضات (في المبيض) وعملية تكوين المنيات (في الخصية). وأثبتت النتائج أن المناسل تمر بست مراحل أساسية للتطور وحتى مرحلة تمام النضج ثم الإلقاء. وتم وصف هذه المراحل الست بالتفصيل لكل من الإناث والذكور.

ويدل وجود بويضات أو منيات في درجات متفاوتة من النضوج الجنسي في المنسل الواحد على أن عملية الإلقاء تتم على دفعات خلال موسم التكاثر وليس على دفعة واحدة.

كما أثبت الفحص النسيجي للمناسل وجود ظاهرة التخنث في بعض الأسماك، حيث يتم تحول السمكة الأنثى إلى ذكر بعد عملية التكاثر مباشرة، أثناء عملية إعادة ترتيب خلايا المنسل، وذلك عند طول كلي ٣٣ سم تقريبا.

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