RESEARCH ARTICLE

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Seasonal Histological Changes in Gonads of the Catfish, *Heteropneustes fossilis* (Bloch, 1794)

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ABSTRACT

Forty mature catfish of both sexes (n=10 per season; 5 males and 5 females) were used to study the effect of different seasons on the histological and histochemical structure of the gonads. The histological results showed that gonads were degenerated during winter, fully matured in spring and distended during summer season. Therefore, winter, spring and summer may be considered as resting, spawning and distending period in the case of freshwater fishes. During autumn, both testes and ovaries appeared as spent gonads where the testes showed many empty seminiferous lobules and the ovaries showed many atretic follicles therefore, autumn was considered as post-spawning or spent season. The results of Gonado-Somatic Index (GSI) were coincided with the histological structure of the gonads where they show peak value during spawning season and showed the lowest value during winter resting season.

Key words: *Histology, Testis, Ovary, Catfish, Seasons*

INTRODUCTION

Catfish is considered as the cheapest source of high quality animal protein and rich in calcium, phosphate, iodine and vitamins (Dadzie and Wangila, 1980). The fishes are also used as a good source of animal meal (Anderson and Mitchum, 1974). The study of the gonads of the different teleost fish attracts the attention of several investigators in this field (Van Oordt, *et al,* 1987; Gaber, 2000; Mousa, 1998; Mousa and Mousa, 1999). The purpose of this work was to study the effect of different seasons on the histological and histochemical structure of the gonads of the catfish.

MATERIALS AND METHODS

A total of 40 mature catfish of both sexes were collected alive from Kushinagar hatchery during different seasons of the study period and transported to the PG Department of Zoology, JaiPrakash University, Chapra. Immediately, the fish was weighted, decapitated and the gonads were removed and weighed after opening the fish belly. After weighing, the gonads were immediately fixed in Bouin's solution for 24 hours, dehydrated through ascending grades of ethanol, cleared in xylene, embedded in paraffin wax and sectioned at 5 m. The sections were stained with Haematoxylin and Eosin, Periodic acid Schiff (PAS), and Crossman's trichrome. Fixative and staining methods were used as outlined by Bancroft et al. (Bancroft, *et al*, 1994).

The GSI (according to Dougbag et al.) was used for following up the seasonal variations in the gonads by the formula-

Weight of gonad GSI = ×100 [11] Fish body weight

RESULTS AND OBSERVATIONS

The results revealed that the gonads of catfish revealed variable structure according to seasons of the year.

TESTIS: During winter, testis showed very thick tunica albuginea and interstitial connective tissue and showed degenerated spermatogenic cells except spermatogonia (Figure 1).

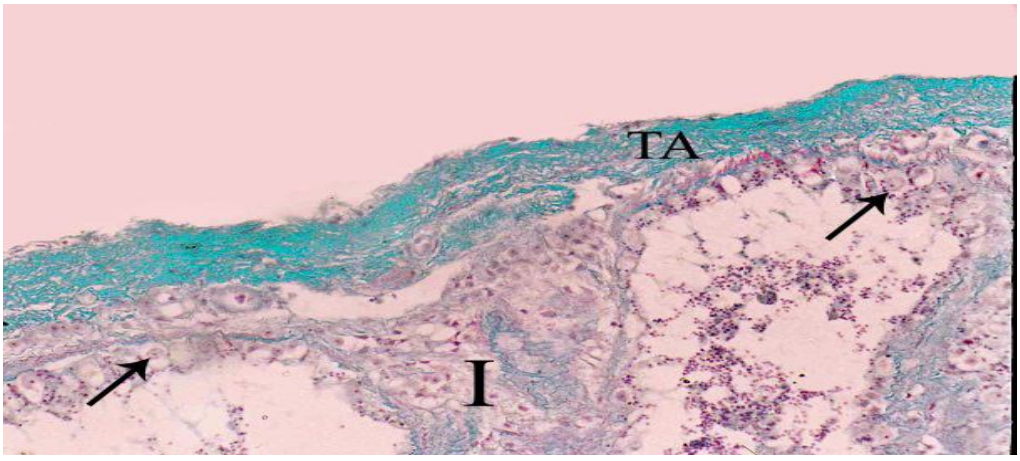

Fig. 1: Section of catfish's testis during winter showing, thick tunica albuginea (TA), increased interstitial connective tissue (I), and intact spermatogonia (arrow).

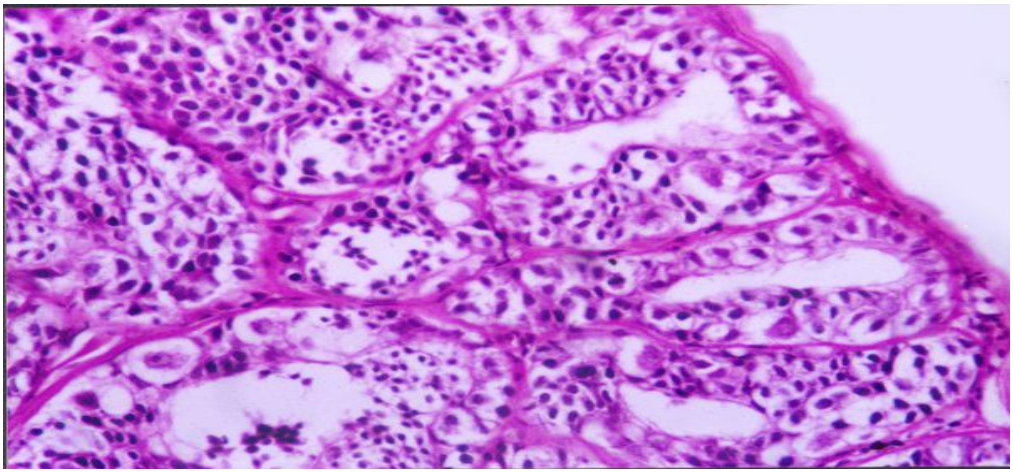

Fig. 2: Section of catfish's testis during spring showing testicular lobules filled with all spermatogenic cells. H&E (×200).

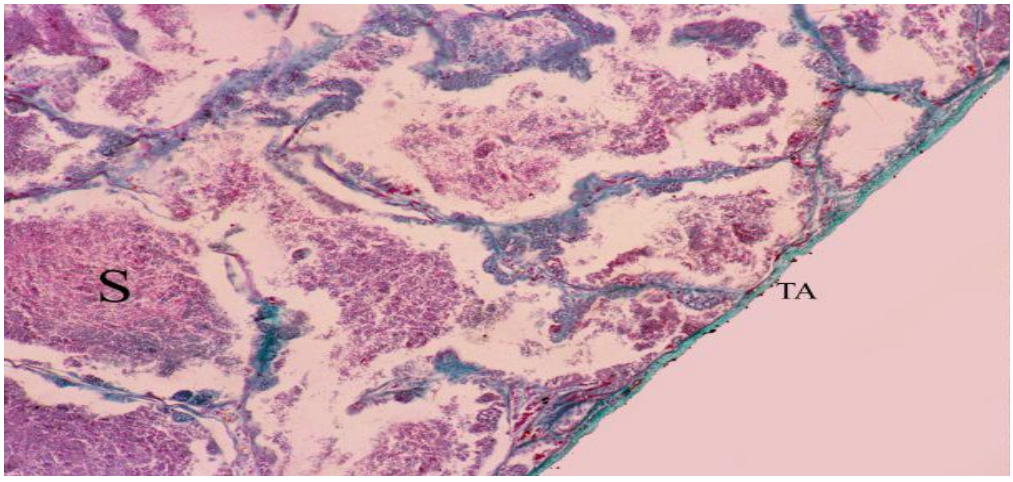

Fig. 3: Section of catfish's testis during summer showing, thin tunica albuginea (TA) compared to Figure 1. Testicular lobules are filled with spermatozoa (S). Crossman's trichrome (×100).

During spring, testicular lobules showed all spermatogenic developmental stages (Figure 2) and continue the same structure during summer where testicular lobules were filled with spermatozoa also, showed thin tunica albuginea and interstitial connective tissue compared to (Figure 3).
During autumn, many testicular lobules appeared empty from speremato zoa while, other spermatogenic cells were present and began to degenerate (Figure 4).

OVARY: During winter, ovary showed very thick tunica albuginea and interstitial connective tissue and showed many degenerated follicles which mainly were of pre-vitellogenic type (Figure 5).

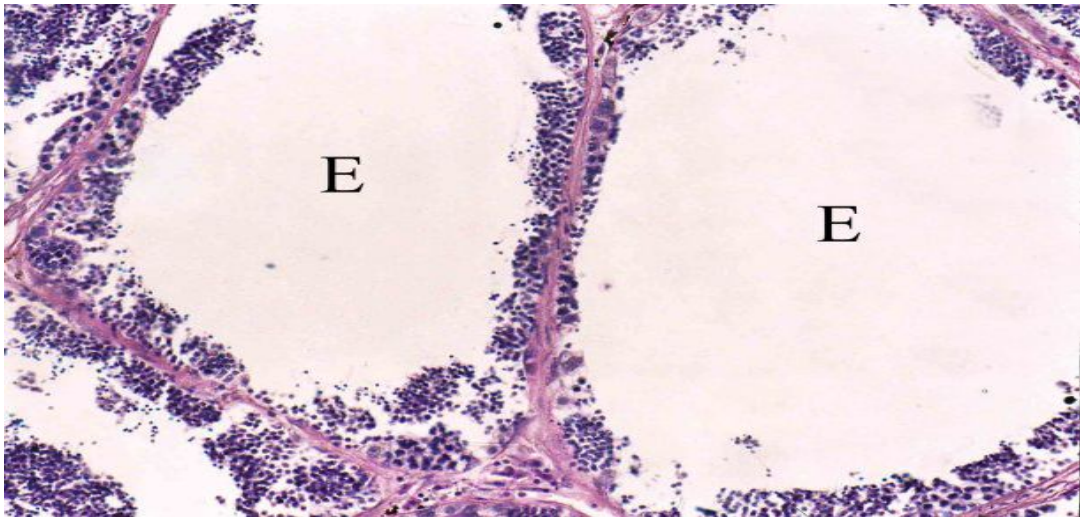

Fig. 4: Section of catfish's testis during autumn showing, empty testicular lobules (E). Notice all developmental stages; spermatogonia (arrow), spermatocytes cyst (SC), spermatid cyst (ST). PAS technique (×200).

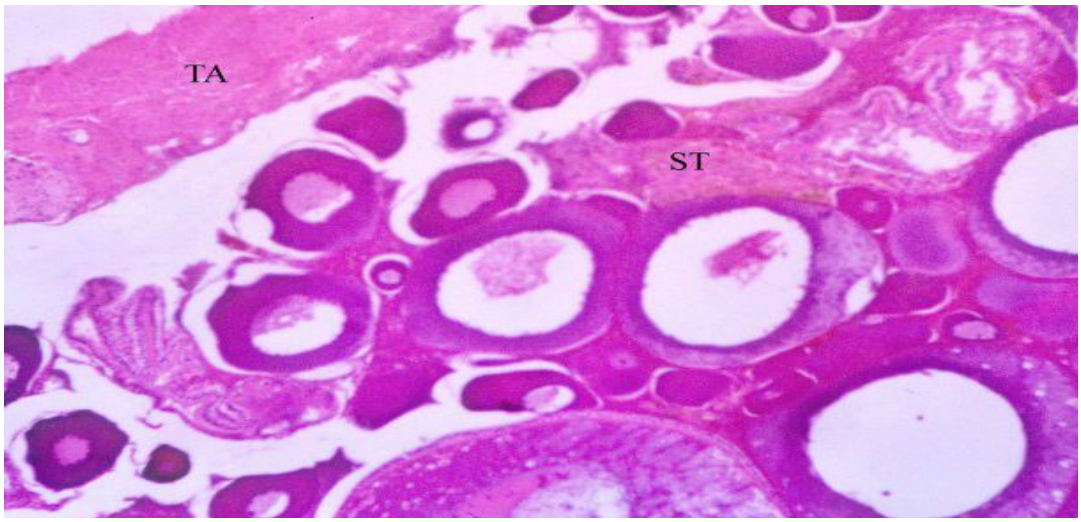

Fig. 5: Section of catfish's ovary during winter showing, very thick tunica albuginea (TA) and increased stromal connective tissue (ST).

During spring, ovary showed all the developmental stages but, the common stages were vitellogenic and post-vitellogenic ones (Figure 6) and continue the same structure during summer where post-vitellogenic (mature) follicles were usually seen, the ovary showed thin tunica albuginea.

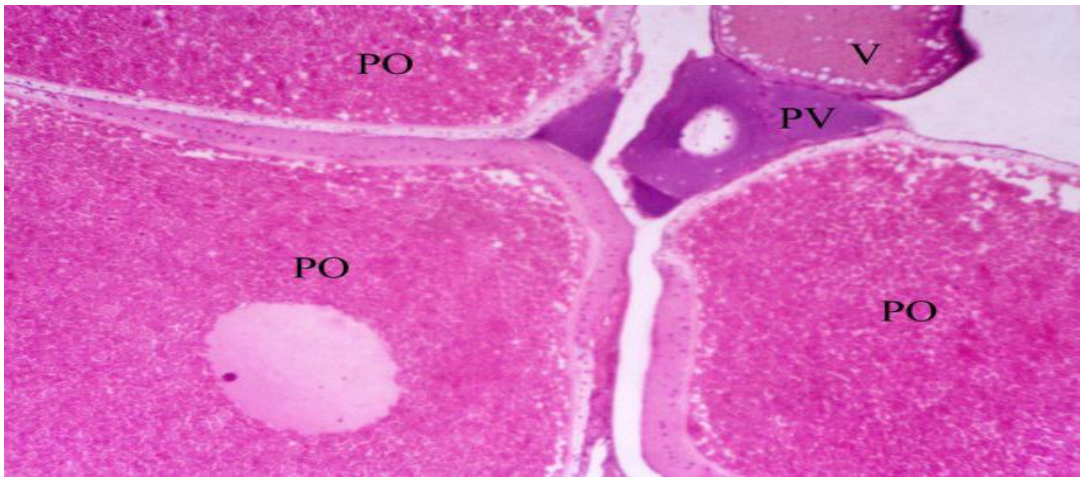

Fig. 6: Section of catfish's ovary during spring showing, pre-vitellogenic follicles (PV), vitellogenic follicles (V) and many post-vitellogenic follicles (PO).

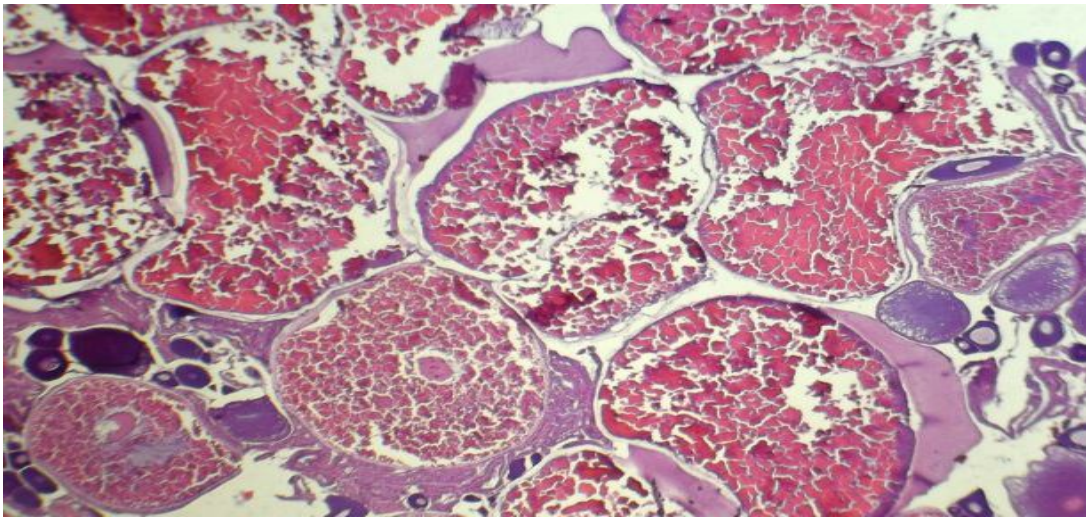

Fig. 7: Section of catfish's ovary during summer showing, abundant mature follicles (MF).

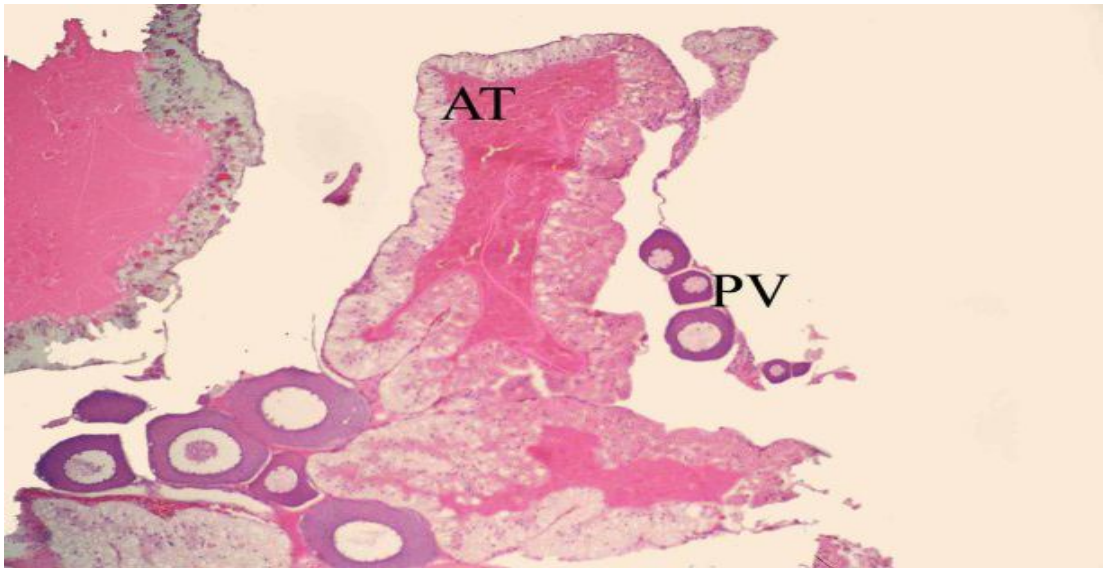

Fig. 8: Section of catfish's ovary during autumn showing, predominance of atretic (AT) and pre-vitellogenic follicles (PV).

DISCUSSION

The tunica albuginea of both testes and ovaries had no uniform thickness all over the year but, it reached a maximum thickness during winter and became thin during spring and summer due to pressure exerted on it by the distended testicular lobules or enlarged mature follicles, and began to increase again during autumn.

The results revealed testicular lobules of variable shapes and sizes according to seasons, where it decreased in size during winter which was cold, rainy and short day light season (resting season) and thereafter increased during spring and reached a maximum size during summer which was hot, dry and long day light season (spawning season) as they were distended by different developmental stages of spermatogenic cells and they showed slight decrease again during autumn which was dry and less hot than spawning season (spent season) but still enlarged and larger as compared to structure during winter. This finding derives support from several studies (Gaber, 2000; Latif and Salem, 1983 and Resink, *et al.*, 1987). The spermatogonia were found throughout the year, but they were abundant during the winter season to replenish the testes after this resting season where the testes showed degeneration and increased interstitial connective tissue. This finding is in conformity to Resink, *et al.* (1987) in *C. gariepinus*. In this study spermatocytes were found throughout the year, but they were abundant during the spawning season is in conformity with Gaber (2000). The spermatids increased during spring to produce spermatozoa and became few during summer as most of them were changed into spermatozoa. The spermatozoa began to appear within lumen of testicular lobules during spring while during summer, the spermatozoa increased and the testicular lobules showed different activity where some lobules were filled with spermatozoa and others were spent or empty as they discharged their content during spawning. Similar findings have also been noticed by Latif and Salem (1983) in *L. nebulosus* and Resink et al (1987) in *C. gariepinus*. During autumn, most of the lobules were empty indicating spawned testes, but some testes were filled with spermatozoa.

The pre-vitellogenic follicles were found throughout the year, but were common in autumn as the spent ovaries and in winter as the resting ovary and less abundant during spring and summer (spawning seasons). This result was supported by studies of Ismail (1992) in *C. lazera*, Salem (1991) and Abel El Hafez, *et al.* (2007) in other fish. The vitellogenic follicles decreased in autumn as the spawning begun to end and rarely observed during winter as it was resting season but, abundant during spring and summer (spawning season) in order to turn rapidly into mature follicles. Maddoch and Burton (1998) reported that the oocytes undergoing vitellogenesis indicate spawning activity. The mature or post-vitellogenic follicles were common and abundant during spring and summer as they were in the the spawning and ready to spawn and ovulate, but rarely observed during the winter (resting) season. The atretic follicles were present throughout the year but they were abundant during autumn (spent ovaries) and winter (resting ovaries) and these atretic follicles indicated the spawned individuals. This finding is similar to those obtained by Gaber (2000) in *Bagrus* and Merson, *et al.* (2000) in summer season.

Another method of studying the seasonal variations of the gonads was the values of Gonado-somatic index (GSI) for both male and female catfish which was used as an indicator of gonadal development as when the GSI reached a maximum value, this gave a perfect indication to the time of spawning. This was supported by Gaber (2000) in *Bagrus* species; Ismail (1992) in *C. lazera* and Khallaf et al. (1991).

The results about GSI were coincided with the obtained histological results where the GSI of both sex reached their minimum values during winter season where the gonads were in resting season, began to increase greatly during spring season, reached their maximum values during summer where the gonads were in the spawning season and began to decrease again during autumn season. This indicated a long spawning season of the catfish extending from spring to summer and might extend into autumn depending on the temperature, but its peak was reached during summer season.

CONCLUSION

The histological results were coincided with GSI as both of them revealed that winter is the resting season of catfish's gonadal activity, spring and summer are the spawning seasons of catfish's gonads, and autumn is post-spawning or spent season of catfish's gonads. These information help in understanding the pattern of catfish reproduction in Egypt that may help in aquaculture of catfish.

REFERENCES

1. Abd El-Hafez E.A., Mahmoud D.M., Ahmed S.M. and Hassan A.H. (2007): Histomorphological changes in the ovaries of Oreochromis niloticus during breeding and non breeding seasons. The 31st conference of the Egyptian society of Histol and Cytol P 28.
2. Anderson D.P. and Mitchum D.L. (1974): Atlas of trout histology textbook. Wyoming Game & Fish Dept., Cheyenne, WY 82009, USA.
3. Bancroft J.D., Cook H.C., Stirling R.W. and Turner D.R. (1994): Manual of histological Techniques and their diagnostic application. 2nd Ed., Churchill Livingston, Edinburgh, London, Madrid, Melbourne, New York and Tokyo.
4. Gaber S.A. (2000): Biological, Histological and Histochemical studies on the Reproductive Organs and Pituitary gland of *Bagrus docmac and Bagrus bayad* in the Nile water, with special reference to the ultrastructure of supporting tissues. Ph.D. Thesis. Zagazig University, Egypt.
5. Ismail R.S. (1992): Physiological study on spawning in some fishes (Clarias lazera). Master Thesis. Fac. of Vet. Med., Zagazig University, Egypt.
6. Khallaf E.A., El-Saadany M.M. and Authman M. (1991): Oogenesis of *Bagrus* bayad (Forsk.). J Egypt Ger Soc Zool., 4: 1-4.
7. Latif A.F. and Salem S.A. (1983): Sexual cycle of Lethrinus nebulosus (Forsk.) in the Red Sea. II. Microscopic peculiarities of the testis. Egypt. J Histol., 6: 141-158.
8. Maddock D.M. and Burton M.P. (1998): Gross and histological observation of ovarian development and related condition changes in American plaice. J Fish Biol., 53: 928-944.
9. Merson R.R., Casey C.S., Martinez C., Soffientino B., Chandlee M. *et al.* (2000): Oocyte development in summer flounder: seasonal changes and steroid correlates. J Fish Biol., 57: 182-196.
10. Mousa S.A. and Mousa M.A. (1999): Immunocytochemical and histological studies on the hypophyseal-gonadal system in the freshwater *Nile tilapia, Oreochromis niloticus*, during sexual maturation and spawning in different habitats. J Exp Zool., 343-354.
11. Resink J.W., Van Den Hurk R., Voorthuis P.K., Terlou M., Leeuw D.E. *et al.* (1987): Quantitative enzyme histochemistry of Steroid and glucuronide Synthesis in testes and seminal vesicle, and its correlation to plasma gonadotropin level in Clarias gariepinus. Aquaculture, 63: 97-114.
12. Salem S.A. (1991): On the sexual cycle of Lethrinus bungus (Ehrenb.) in the Egyptian Red Sea coast. I. Microscopic Peculiarities of the ovary. Egypt, J Histol., 14: 55-62.