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SOME MORPHOLOGICAL CHANGES OF EMBRYO AND LARVAE OF S*olea aegyptiaca* AND *Solea vulgaris*

Safaa Sharaf[1]; Mohamed W. Ali[2];

Safaa S. Abdelkawy[3] and Abd Elazem M. Abd Elazem[2]

[1]*Department of animal production and fish resources faculty of Agriculture, Suez Canal University.*

[2]*Department of fish physiology and spawning, central laboratory for Aquaculture Research Abbaasa.*

[3]*National institute of Oceanography and Fisheries, Shakshok El-Fayom branch.*

Abstract

Fishes used in this study were soles fish species, S*olea aegyptiaca* and *Solea vulgaris* from Qarun Lack and Bardawil Lack respectively, Egypt. The experimental fish were transported to Shakshouk, Fayoum governorate, National Institute of Oceanography and fisheries by using car fish supplied by pure oxygen cylinder. Fishes were acclimatized for two weeks and fed on commercial diet contained (40%) crude protein. The experiment was stocked in fiberglass tanks. The experiment was distributed as females *Solea aegyptiaca* with male and *Solea aegyptiaca* and females *Solea vulgaris* with male *Solea vulgaris*. Total number of fish 18 females plus 9 males from Qarun Lack and 18 females plus 9 males from Bardawil lack by sex ratio 2females:1male for each tank with three replicates for each treatment. These treatments were injected with pituitary gland extract 4 mg/kg of body weight for all treatment. Morphometric measurements of 30 preserved undistorted larvae from each sample were made using an ocular micrometer on a stereo microscope. Samples of yolk-sac larvae were taken at regular intervals after hatching until the yolk reserves were almost exhausted. They were also anaesthetized and preserved in 50:50 sea water and buffered formal saline. Standard length (sl) was measured from the anterior extremity of a larva (or the tip of the upper jaw after the mouth had formed) to the posterior end of the notochord.

Key word: Eggs, larvae, Yolk, *Solea aegyptiaca Solea vulgaris*, Head length, Trunk length, Tall, eye, Hatching.

INTRODUCTION

Egg characteristics diameter of solea was 1.0-1.60 mm (Bedoui 1995), higher production of eggs and spermatozoa density was in wild-captured brood stocks (Cabrita *et al.,* 2006), Egg yield (eggs/kg female) of solea 140000-200000 (Imsland *et al.,* 2004). Optimal temperature for gamete development was °C≈19°C for senegalensis and 12-15ºC, for solea, Howell (1997).The better rate of fertilization success was 50-100% depended on egg and sperm quality Howell (1997). Overall incubation of egg gametes were successes by 30-80% Howell (1997). Larvae-Juvenile Stage, larval size at hatching was ≈2.2-2.9 m for senegalensis and 4-5 mm for solea; Dinis *et al.* (1999). The optimal water temperature was °C19-24°C in the first 60 days after hatching for larval development (Imsland *et al.,* 2004). Fiberglass or concrete tanks of various sizes are suitable rearing units for *senegalensis* and solea (Imsland *et al.,* 2004 and Howell, 1997). Authors found that the first feed of larvae begin at 3 days post hatch (dph) (Imsland *et al*., 2004 and Howell, 1997). Whereas the standardized industrialized production is artemia from 3-40 dph and formulated feed from 28-35 dph (Imsland *et al*., 2004 and Day *et al.,* 1999). Imsland *et al.* (2004) and Howell (1997) stated that the survival rate of larvae from hatching to weaning was 40-80%, rearing of the larvae though to metamorphosis presents few problems as compared to other flatfish species. The suitable time for spawning commence of solea was through March to mid- May Imsland *et al.* (2004), and while April to June was suitable for senegalensis (Dinis *et al.*, 1999 and Dinis *et al*., 2003), but this time was controlled by photoperiod (Devauchelle, *et al.*,1987), and temperature 8-12ºC (Lenzi *et al*., 1989 and Dinis *et al*., 2003). Imsland *et al*. (2004) and Dinis *et al*. (2003) showed that fertilization mode was natural spawning, while Devauchelle *et al.*, 1987 and Howell (1997) showed that fertilization by stripping appears not feasible. Fertilization protocol of eggs was collected in the water column by special net (Devauchelle *et al.* 1987 and Howell 1997). The age to reach sexual maturity in the wild was 4-6 years (Bromley (2003) whereas it reach this age at 3- 4 years in captivity (Baynes *et al*. 1993 and Howell, 1997). The optimal temperature was ranged from 18ºC to 20ºC for spawning of solea (Imsland *et al*., 2004 and Lenzi *et al.* (1989). The optimal temperature was ranged from 8ºC to 12ºC for spawning of senegalensis (Howell 1997 and Dinis *et al*., 2003). Spawning time of solea and senegalensis can shifted by photoperiod and temperature manipulation (Lenzi *et al.* 1989).

Common sole (*Solea solea* L.) is a very promising candidate for European aquaculture, characterized by high flesh quality, high market value and a total production of ~30 tons per year (Howell *et al*., 2008). There are though, several critical factors to be overcome in order to standardize a massive farming production, feeding behavior, susceptibility to disease and stocking density (Imsland *et al*., 2004 and Schram *et al.*, 2006), as well as juvenile production (Howell *et al*., 2008) especially around weaning and metamorphosis which are accompanied by increased mortality rates (Rueda-Jasso *et al*., 2005). Standard feeding regimens during these periods represent a bottleneck for fish farmers due to the required administration to young larvae of live-feed usually characterized by variable availability and price fluctuations of artemia cysts (Callan *et al.*, 2003), which can reach 700% (Moretti *et al.*, 2005); and poor hygienic conditions and high levels of pathogenic bacteria (Olafsen, 2001) The utilization of a co-feeding regimen, which gradually weans larvae off live preys, has been able to promote digestive maturation at early age (Engrola *et al.*, 2007 and 2009) and to improve growth performances and survival rate of marine fish larvae (Rosenlund *et al.*, 1997).

The mouth of the sole is positioned so as to facilitate picking up objects from the bed of the sea. Solids have been considered apt for commercial aquaculture since the end of 19th century and the beginning of the 20th century. The choice of the feeding strategy to adopt at weaning should be based on the post larvae weight as it is a better indicator of the developmental stage and physiological status of the post larvae (Engrola *et al*., 2007). Taste buds in fish are found on tongue, the surface of the pharynx, lips and on the barbles around the mouth, gills, pectoral fins or the trunk (Abbate *et al.*, 2010). Taste buds distribution is a species specific adaptation to the habitat, food preference and feeding behavior (Cinar *et al.* 2008 and Tripathi, 2010). Among the Euteleostean order Pleuronectiformes (flatfishes), the family Soleidae is characterized by asymmetrical features, especially by their oral jaw apparatus. (Burgin, 1987 and Chapleau and Kesta, 1988). The oral jaw apparatus includes a much reduced premaxilla on the ocular side and a shortened mandible with a high coronoid process on the blind side (Btirgin, 1987) The present work was under taken to investigate the surface architecture of the asymmetrical buccal cavity of *Solea solea* (*S. solea*) in relation to its food and feeding habits which helps in aquaculture.

Aim of study, the present work is conducted to study some morphological changes of embryo and larvae of *solea aegyptiaca* collected from Qarun Lack and *solea vulgaris* collected from Bardawil Lack.

MATERIALS AND METHODS

The present study was conducted using the research facilities of Central Laboratory for Aquaculture Research (CLAR) Abbassa and the experimental Station at Shakshouk Fayoum Governorate of National Institute of Oceanography and Fisheries (NIOF). Fishes used in this study were sole fish species, S*olea aegyptiaca* and *Solea vulgaris* from Qarun Lack and Bardawil Lack respectively, Egypt. The experimental fish were transported to Shakshouk Station, by using car fish supplied by pure oxygen cylinder. Fishes were acclimatized for two week and fed on commercial diet contained (40%) crude protein. The experiment was applied in Fiberglas tanks. The experiment was distributed as females *Solea aegyptiaca* with male of *Solea aegyptiaca* and females *Solea vulgaris* with male *Solea vulgaris*. Total number of fish 18 females plus 9 males from Qaroun Lack and 18 females with 9 males from Bardawil Lack by sex ratio 2 females: 1 male for each tank with three replicates for each treatment. These treatments were injected with pituitary gland extract 4 mg/kg of body weight for all treatment. Morphometric measurements of 30 preserved undistorted larvae from each sample were made using an ocular micrometer on a stereo microscope. Samples of yolk-sac larvae were taken at regular intervals after hatching until the yolk reserves were almost exhausted.

They were also anaesthetized and preserved in 50:50 sea water and buffered formal saline. Standard length (sl) was measured from the anterior extremity of a larva (or the tip of the upper jaw after the mouth had formed) to the posterior end of the notochord. My tome height (mh) was measured immediately above the anus, and the length of the lower jaw was measured from the tip to the angle of the mandible. Yolk sac depth (yd), width (yw) and length (yl) were the maxima for each dimension. Additional information relating egg size and larval size at hatch was obtained from eggs that were collected regularly from the brood stock tank during the spawning season. Metamorphosis degree was evaluated on 20 larvae/ tank. Degrees of metamorphosis were divided into 5 phases;1) symmetrical left and right eye position, 2) an asymmetrical position of the left eye and right eye, the left eye starts to migrate, 3) the migrating eye reaches at maximum the midline of the dorsal surface, 4) the migrating eye can be seen from the right ocular side or migrates within the dorsal side and 5) eye translocation is completed and the orbital arch is visible.

RESULTS

Table 1. Mean values (Mean ±S.D. n=20) of eye diameter (um) and space between eyes (um) of *Solea aegyptiaca* during complete embryo inside egg until 30 days of fry rearing.

Stage	***Solea aegyptiaca***	
parameter	**Eye diameter (mm)**	**Distance between eyes (mm)**
Stage (4) embryo Inside membrane	0.13± 0.01[e]	
New hatching	0.16±0.02[e]	
1st day	0.16±0.01[e]	
2nd day	0.16±0.01[e]	
4 day	0.20±0.02 [d]	
10 day	0.22±0.03[d]	
15 day start of eye migration	0.32±0.03[c]	
20 day final of eye migration	0.40±0.04[b]	0.29±0.02[a]
26 day	0.40±0.03[b]	0.26±0.03[a]
30 day	0.62±0.05[a]	0.26±0.02[a]

Means with the same letter in the same column are not significant (P< 0.05).

Table 1 showed that eye diameter of larva of *Solea aegyptiaca* gradually increased with increasing age of larvae where it was highly significant increased at 30 days. It was significantly decreased with low value inside fertilized egg (0.13± 0.01) while eye diameter at 30 days after hatching was recorded (0.62±0.05 mm). In the same table distance between eyes was measured after 20, 26 and 30 days from hatching 0.29±0.02, 0.26±0.03 and 0.26±0.02 mm respectively.

Table 2. Mean values (Mean ±S.D.n=20) of eye diameter (um) and space between eyes (um) of *Solea vulgaris* during complete embryo inside egg until 30 days of fry rearing.

Stage / **Parameter**	***Solea vulgaris***	
	Eye diameter (um)	**Space between eyes (mm)**
Stage (4)embryo Inside membrane	0.15 ±0.01[d]	
New hatching	0.15±0.01[d]	
1st day	0.16±0.01[d]	
2nd day	0,15±0.02[d]	
4 day	0.21±0.02[c]	
10 day	0.24±0.01[c]	
15 day start of eye migration	0.24±0.02[c]	
20 day final of eye migration	0.33±0.02[b]	0.31±0.03[a]
26 day	0.45±0.04[a]	0.27±0.02[a]
30 day	0.45±0.05[a]	0.27±0.02[a]

Means with the same letter in the same column are not significant (P< 0.05).

Table 2 showed that eye diameter of larva of *Solea aegyptiaca* gradually increased with increasing age of larvae where it was highly significant increased at 30 days. It was significantly decreased with low value inside fertilized egg (0.15 ±0.01) while eye diameter at 30 days after hatching was recorded (0.45±0.05 mm). In the same table distance between eyes was measured after 20, 26 and 30 days from hatching 0.31±0.03, 0.27±0.02 and 0.27±0.02 mm respectively

This Table 3: showed that the number of oil globule of *Solea aegyptiaca* gradually increased with increasing time where the number of oil globules were increased from stage (1) ripe egg, stage (2) fertilizers eggs then stage (3) end of gastrula and stage (4) embryo inside membrane were 15±1, 17±1, 18±1and 20±2 respectively. Oil globule diameter (mm) was increased gradually from ripe egg stage to formation of embryo within egg in stage (4) 0.13±0.01 and 0.35±0.02 (mm) respectively (mm). Yolk diameter (mm) was ranged from 0.76±0.02 to 0.85±0.06 mm in stage 4 and stage 1 respectively. Diameter of egg (mm) was non significant difference form ripe egg to form of embryo within egg.

Table 3. Mean values (Mean ±S.D. n=20) of umber of oil globule, oil globule diameter (mm), Yolk diameter (um), egg diameter (mm) of *Solea aegyptiaca* during stage ripe egg, stage fertilized eggs, end of gastrula and embryo stage.

Stage / **Parameter**	***Solea aegyptiaca***			
	Number of oil globule	**Oil globule diameter (mm)**	**Yolk diameter (mm)**	**Egg diameter (mm)**
Stage (1) ripe egg	15±1[b]	0.13±0.01[c]	0.85±0.06[a]	0.92±0.08[a]
Stage (2) fertilizers eggs	17±1[b]	0.29±0.02[b]	0.82±0.04[a]	0.92±0.05[a]
Stage(3) end of gastrula	18±1[ab]	0.30±0.01[b]	0.78±0.03[a]	0.93±0.06[a]
Stage (4) embryo. Inside membrane	20±2[a]	0.35±0.02[a]	0.76±0.02[ab]	0.93±0.07[a]

Means with the same letter in the same column are not significant (P< 0.05).

This Table 3: showed that the number of oil globule of *Solea aegyptiaca* gradually increased with increasing time where the number of oil globules were increased from stage (1) ripe egg, stage (2) fertilizers eggs then stage (3) end of gastrula and stage (4) embryo inside membrane were 13±1, 15±1, 15±1and 18±1respectively. Oil globule diameter (mm) was increased gradually from ripe egg stage to formation of embryo within egg in stage (4) 0.20±0.02and 0.60±0.08 (mm) respectively. Yolk diameter (mm) was ranged from 0.81±0.04 to 0.93±0.04 (mm) in stage 4 and stage 1 respectively.

Lengths and widths of larvae were recorded in Table (5). Total length was initiated at newly hatching larvae and ended after 30 days of hatching (1.07±0.15 and 7.34±0.22 mm) respectively. But head length was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.3±0.02, 0.31±0.03, 0.32±0.02, 0.35±0.02, 0.63±0.04, 0.9±0.05, 1.41±0.1, 2.4±0.13 and 2.4±0.11mm) respectively, Trunk length was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.57±0.02, 0.60±0.03, o.60±0.04, 0,75±0.04, 0.88±0.09, 0.96±0.04, 0.99±0.09, 1.29±0.12 and 1.39±0,11mm) respectively and tail length was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.20±0.03, 0.20±0.02, 0.22±0.01, 1.5±0.18, 1.65±0.14, 2.25±0.19, 2.37±0.16, 3.06±0.18and 3.55±0.21mm) respectively. But head width was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.65±0.08, 0.75±0.07, 1.14±0.09, 1.35±0.13, 1.55 ±0.11, 2.16±0.14and 2.89±0.15mm) respectively, Trunk width was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.65±0.05, 0.85±0.12, 0.95±0.11, 1.14±0.13, 2.29±0.15, 3.0±0.11and 3.25±0.14mm) respectively and tail width was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.71±0.03,, 0.76±0.04, 1.35±0.11, 1.55±0.09, 1.95±0.11, 2.9±0.17 and 3.5±0.15mm) respectively.

Table 4. Mean values (Mean ±S.D. n=20) of number of oil globule, oil globule diameter (mm), Yolk diameter (um), egg diameter (mm) of *Solea vulgaris* during ripe egg, fertilized eggs, end of gastrula and embryo stage.

Stage	***Solea vulgaris***			
Parameter	**Number of oil globule**	**Oil globule diameter (mm)**	**Yolk diameter (mm)**	**Diameter of egg (mm))**
Stage (1) ripe egg	13±1^{c}	0.20±0.02^{c}	0.93±0.04^{a}	0.99±0.05^{a}
Stage (2) fertilizers eggs	15±1^{b}	0.30±0.04^{b}	0.88±0.04^{ab}	0.99±0.04^{a}
Stage(3) end of gastrula	15±1^{b}	0.60±0.07^{a}	0.86±0.02^{ab}	0.96±0.07^{a}
Stage (4) embryo. Inside membrane	18±1^{a}	0.60±0.08^{a}	0.81±0.04^{b}	0.93±0.08^{a}

Means with the same letter in the same column are not significant (P< 0.05).

Table 5. Mean values (Mean ±S.D. n=20) of total length (mm), head length (mm), trunk length (mm),tail length (mm),head width (mm), trunk width (mm) and tail width (mm), of *Solea aegyptiaca* larvae during Newly hatching after 30 days.

Stge Parameter	*Solea aegyptiaca*						
	Total length (mm)	**Head length (mm)**	**Trunk length (mm)**	**Tail length (mm)**	**Head width (mm)**	**Trunk width (mm)**	**Tail width (mm)**
Newly hatching	1.07±0.15^{g}	0.30±0.02^{e}	0.57±0.02^{c}	0.20±0.03^{e}			
1st day	1.13±0.11^{g}	0.31±0.03^{e}	0.60±0.03^{c}	0.20±0.02^{e}			
2nd day	1.18±0.11g	0.32±0.02^{e}	o.60±0.04^{c}	0.22±0.01^{e}	0.65±0.08^{e}	0.65±0.05^{e}	0.71±0.03^{e}
4 day no pigmented	2.58±0.17^{f}	0.35±0.02^{e}	0,75±0.04^{b}	1.5±0.18^{d}	0.75±0.07^{e}	0.85±0.12^{b}	0.76±0.04^{e}
10 day notochord	3.30±0.18^{e}	0.63±0.04^{d}	0.88±0.09^{b}	1.65±0.14^{d}	1.14±0.09^{d}	0.95±0.11^{b}	1.35±0.11^{d}
15 day start of eye migration	4.11±0.23^{d}	0.9±0.05^{c}	0.96±0.04^{b}	2.25±0.19^{c}	1.35±0.13^{c}	1.14±0.13^{c}	1.55±0.09^{d}
20 day complete migration	4.77±0.29^{c}	1.41±0.17^{b}	0.99±0.09^{b}	2.37±0.16^{c}	1.55±0.11^{c}	2.29±0.15^{b}	1.95±0.11^{c}
26 day complete metamorphosis	6,75±0.17^{b}	2.4±0.13^{a}	1.29±0.12^{a}	3.06±0.18^{b}	2.16±0.14^{b}	3.0±0.11^{a}	2.9±0.17^{b}
30 day	7.34±0.22^{a}	2.40±0.11^{a}	1.39±0,11^{a}	3.55±0.21^{a}	2.89±0.15^{a}	3.25±0.14^{a}	3.5±0.15^{a}

Means with the same letter in the same column are not significant (P< 0.05)

Lengths and widths of larvae were recorded in Table (6). Total length was initiated at newly hatching larvae and ended after 30 days of hatching (1.07±0.15 and 7.34±0.22 mm) respectively. But head length was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.24±0.09, 0.35±0.12, 0.52±0.17, 0.66±0.03, 0.86±0.04, 1.40±0.09, 2.08±0.0.11, 2.46±0.12 and 3.04±0.11mm) respectively, Trunk length was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (1.14±0.11, 1.19±0.18, 1.20±0.11, 1,40±0.21, 1.62±0.11, 2.20±0.11, 3.02±0.17, 4.06±0.13 and 5.58±0.14 mm) respectively and tail length was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.82±0.08, 0.96±0.07, 1.75±0.22,1.92±0.23, 1.98±0.21, 2.90±0.1, 4.20±0.6, 5.80±0.2 and6.80±0.3mm) respectively. But head width was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.56±0.08, 0.62±0.04, 0.90±0.04, 1.18±0.11, 2.01±0.16, 1.74±0.14 and 3.01±0.15mm) respectively, Trunk width was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.04±0.01, 0.66±0.03, 1.22±0.21, 1.54±0.11, 2.04±0.13, 3.00±0.15 and3.4±0.34mm) respectively and tail width was increased for new hatching throughout 1, 2, 4, 10, 15, 20, 26 and 30 days after hatching (0.90±0.08, 0.90±0.07, 1.44±0.07, 1.80±0.09, 2.36±0.11, 2.36±0.11, 3.36±0.24 and 3.80±018mm) respectively.

Table 6. Mean values (Mean ±S.D. n=20) of total length (mm), tail length (mm), trunk length (mm), head length (mm), tail width (mm), trunk width (mm) and head width (mm) of *Solea vulgaris* larvae during Newly hatching after 30 day.

Stage / Parameter	***Solea vulgaris***						
	Total length (mm)	**Head length (mm)**	**Trunk length (mm)**	**Tail length (mm)**	**Head width (mm)**	**Trunk width (mm)**	**Tail width (mm)**
Newly hatching	2.20±0.2[f]	0.24±0.09[f]	1.14±0.11[ef]	0.82±0.08[e]			
1st day	2.50±0.3[f]	0.35±0.12[f]	1.19±0.18[ef]	0.96±0.07[e]			
2nd day	3.47±0.5[ef]	0.52±0.17[e]	1.20±0.11[e]	1.75±0.22[d]	0.56±0.08[e]	0.04±0.01[e]	0.90±0.08[e]
4 day no Pigmented	3.98±0.4[e]	0.66±0.03[e]	1,40±0.21[e]	1.92±0.23[d]	0.62±0.04[e]	0.66±0.03[d]	0.90±0.07[e]
10 day notochord	4.36±0.6[e]	0.86±0.04[d]	1.62±0.11[e]	1.98±0.21[d]	0.90±0.04[d]	1.22±0.21[c]	1.44±0.07[d]
15 day start of eye migration	6.50±0.4[d]	1.40±0.09[c]	2.20±0.11[d]	2.90±0.1[c]	1.18±0.11[c]	1.54±0.11[c]	1.80±0.09[c]
20 day complete migration	9.30±0.8[c]	2.08±0.0.11[b]	3.02±0.17[c]	4.20±0.6[b]	2.01±0.16[b]	2.04±0.13[b]	2.36±0.11[b]
26 day complete Metamorphosis	12.32±1.03[b]	2.46±0.12[b]	4.06±0.13[b]	5.80±0.2[b]	1.74±0.14[b]	3.00±0.15[a]	3.36±0.24[a]
30 day	15.42±1.15[a]	3.04±0.11[a]	5.58±0.14[a]	6.80±0.3[a]	3.01±0.15[a]	3.4±0.34[a]	3.80±018[a]

Means with the same letter in the same column are not significant (P< 0.05).

Results in Table (7) showed that, the highest average value of mouth opening was significantly increase with the increasing age in *Solea aegyptiaca* were the highest value was recorded at 30 day after hatching (0.70±0.05 mm) and the lowest value showed in 4 day after hatching

(0.13±0.01mm). Solea vulgaris showed that, highest value was recorded at 30 day after hatching ((0.78±0.07 mm) and the lowest value was showed in 4 day after hatching (0.16±0.02 mm).

Table 7. Mean values (Mean ±S.D. n=20) of mouth opening of *Solea vulgaris* and *Solea aegyptiac* larvae from 4 to30 day after hatching**.**

stage / parameter	*Solea aegyptiaca*	*Solea vulgaris*
	Mouth opening (mm)	**Mouth opening (mm)**
4 day	0.13±0.01^{d}	0.16±0.02^{f}
10 day	0.18±0.02^{c}	0.21±0.02^{e}
15 day	0.22±0.02^{c}	0.25±0.03^{d}
20 day	0.48±0.04^{b}	0.53±0.06^{c}
26 day	0.55±0.06^{b}	0.63±0.03^{b}
30 day	0.70±0.05^{a}	0.78±0.07^{a}

Means with the same letter in the same column are not significant (P< 0.05)

Table 8. Mean values (Mean ±S.D. n=20) of egg number, fry number, hatch percent, Relative fecundity and Absolute fecundity during batch (1,2and 3) of *Solea aegyptiaca*.

stage / parameter	*Solea aegyptiaca*				
	Egg number	**Fry number**	**Hatching (%)**	**Relative fecundity**	**Absolute fecundity**
Batch 1	33650±1250^{a}	30500±2014^{a}	90.6±2.3^{a}	268	6970
Batch 2	15300 ±874^{b}	13100±714^{b}	86.3±1.9^{b}		
Batch 3	3800±350^{c}	3250±247^{c}	85.6±1.7^{b}		

Means with the same letter in the same column are not significant (P< 0.05)

From the obtained data in table 8 egg number in each different three batches showed that the highest number was recorded in first batch then second batch and finally in third batch (33650±1250, 15300 ±874 and 3800±350) respectively. Fry numbers of *Solea aegyptiaca* were recorded in first batch then second batch and finally in third batch (30500±2014, 13100±714 and 3250±247) respectively so, hatching percentage were recorded in first batch then second batch and finally in third batch (90.6±2.3, 86.3±1.9 and 85.6±1.7%) respectively.

Table 9. Mean values (Mean ±S.D. n=20) of egg number, fry number, hatch percent, Relative fecundity and Absolute fecundity during batch (1,2and 3) of *Solea vulgaris*.

Stage / Parameter	*Solea vulgaris*				
	Egg number	**Fry number**	**Hatching (%)**	**Relative fecundity**	**Absolute fecundity**
Batch 1	38750±2027[a]	36950±1870[a]	95.3±1.9[a]	246	9363
Batch 2	18430±1015[b]	16250±914[b]	88.1±2.1[b]		
Batch 3	4050± 630[c]	3550±521[c]	87.6±1.8[b]		

Means with the same letter in the same column are not significant ($P < 0.05$)

From the obtained data in Table 9 egg number in each different three batches showed that the highest number was recorded in first batch then second batch and finally in third batch (38750±2027, 18430±1015 and 4050± 630) respectively. Fry numbers of *Solea aegyptiaca* were recorded in first batch then second batch and finally in third batch (36950±1870, 16250±914 and 3550±521) respectively so, hatching percentage were recorded in first batch then second batch and finally in third batch (95.3±1.9, 88.1±2.1 and 87.6±1.8 %) respectively.

DISCUSSION

Eye diameter of two eyes were be increased with the times from embryo until thirty days after hatching also, The distance between two eyes were be increased from 20 days to 30 days after hatching these results were agreement with in flatfish, metamorphosis is characterized by very clear morphological (e.g. eye migration and a 90° rotation in posture), anatomical and physiological transformations which give rise to new types of behavior and induce the transition from a pelagic to a benthic lifestyle. Metamorphosis is a stage which requires a lot of energy (Balon *et al.,* 1986). In a certain number of species it corresponds to a period of nutritional crisis (Laurence, 1986 and Tanaka *et al.,* 1972) strong metabolic changes together with the slowing down of metabolic activity (Youson, 1988) and a re-calibration of vision in order to detect prey (Osse and Van Den Boogaart *et al.*, 1997). All of these phenomena can increase the vulnerability of the larvae. The diameter of eggs produced by spawning populations of sole decreases progressively during the spawning season, both in the sea (Rijnsdorp and Vingerhoed, 1994) and in captivity (Houghton *et al.,* 1985). Egg diameter, oil globule diameter and number of oil globule were be increased after fertilization until before hatching whereas, yolk diameter was decreased in the direction these results were agreement with Marteinsdottir and Able (1992) they stated that the amount of yolk remaining at the time the larva is first able to feed will depend both on egg size and the efficiency with which the yolk is utilized. Variation in the quantity of yolk has been shown to influence size, growth rate and early feeding activity of the hatched larvae of other species. The presence of a larger quantity of yolk is thought to reduce the risk of starvation before exogenous feeding begins. A period of mixed feeding, before the yolk reserves become exhausted, may be important in the early larval growth of some species, e.g., the halibut, *Hippoglossus hippoglossus*, (Pittman *et al.,* 1990). Total length, head, trunk and tail lengths were be noticed increased with increasing time after hatching until 30 days after hatching, also head, trunk and tail widths were be increased with increasing time from second days after hatching to 30 days after hatching these obtained results hand with hand Houde, 1989 who found that fish larvae are known to present high growth rates when compared to older fish. The importance of solving the nutritional requirements of the larvae with a balanced feed in earlier phases is essential because otherwise the growth, food conversion efficiency (Conceição *et al.*, 2003), and even survival (Aragão *et al.*, 2007) may be lower. The development of an inert diet that is well ingested, digested and assimilated by larvae at mouth opening, has long been an objective of fish larvae researchers. Currently Artemia replacement diets are a feeding strategy widely used in fish larvae culture since inert diets are easier to use and have a stable composition, while composition of live feed can vary according to culture/enrichment conditions. The importance of the early feeding regimes was observed during weaning of barramundi (Curnow *et al.,* 2006)

So, the mouth opening in *solea aegyptiaca* and *solea vulgaris* were be measured at the ending of yolk sac and beginning of mouth open and starting natural feeding by rotifer, the obtained results founded that the increase in mouth opening with increasing the age of the larvae from three days until 30 days after hatching these results agreement with the following authors Saadatfar *et al.* (2010) when they found that the taste buds of teleost varied in structure depending on the species examined and even on their location in the body. Taste buds in fish participate in food identification by detecting distinct chemical substances at short distance (Devitsina *et al.,* 2010). From the obtained data showed there is strong relationship between the batch number and larval number in each batch and gradually decreased with increasing batches time these results are in agreement with Simpson (1956) who found that the size range of eggs produced by the common sole, *Solea solea* (L.), is particularly wide amongst the Northeastern Atlantic fishes. There is more than a four-fold difference between the volume of the yolk reserves of the largest (1.58 mm diameter) and the smallest (0.95mm diameter) eggs reported.

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بعض التغيرات الظاهرية فى جنين ويرقات سوليا اجيبتياكا وسوليا فولجاريس

صفاء شرف[١]، محمد وفيق على[٢]،

صفاء صالح عبد القادر[٣]، عبد العظيم محمد عبد العظيم[٢]

[١] *قسم الانتاج الحيوانى والثروة السمكية كلية الزراعة جامعة قناة السويس.*

[٢] *قسم الفسيولوجى والتفريخ المعمل المركزى لبحوث الثروة السمكية.*

[٣] *قسم الفسيولوجى والتفريخ المعهد القومى لعلوم البحار والصايد شكشوك الفيوم.*

الملخص العربى

الاسماك المستخدمة فى هذة الدراسة اسماك موسى سوليا اجيبتياكا من بحيرة قارون وسوليا فولجاريس من بحيرة البردويل. الاسماك المستخدمة فى التجربة نقلت الى محطة معهد علوم البحار والمصايد شكشوك محافظة الفيوم بواسطة سيارة نقل الاسماك المزودةباسطوانة اكسوجين نقى.تم اقلمة الاسماك لمدة اسبوعين وتم تغذيتها على عليقة تجارية (٤٠%) بروتين.تم تخزين اسماك التجربة فى احواض فيبر جلاس. التجربة وزعت اناث سوليا اجيبتياكا مع ذكور سوليا ايجيبتياكا واناث سوليا فولجاريس مع ذكور سوليا فولجاريس. اجمالى عدد الاسماك١٨اناث مع ٩ ذكور من بحيرة قارون و١٨ اناث مع ٩ذكور من بحيرة البردويل. وكانت النسبة الجنسية ٢ اناث الى ١ ذكور فى كل تانك .وكانت لكل معاملة ٣ مكررات. وهذة المعاملات حقنت بمستخلص الغدة النخامية ٤ ملى جرام لكل كجم وزن حى. القياسات الظاهرية لعينة ٣٠ يرقة محفوظة غير مشوهة تمت تحت ميكرسكوب ضوئي. عينات كيس المح واليرقات اخذت بانتظام بعد الفقس وحتى استنفاذ كيس المح تقريبا. وتم تخدير العينة وحفظها فى ماء البحر ومحلول ملحى بمعدل ٥٠: ٥٠ ثم تم قياس الطول القياسى من مقدمة اليرقة (من مقدمة الفك العلوي بعد اكتمال فتحة الفم) وحتى النهاية الخلفية من الحبل الظهرى.